Aspects of Infant Mortality in a University Town, Cambridge 1875-1911

Thesis

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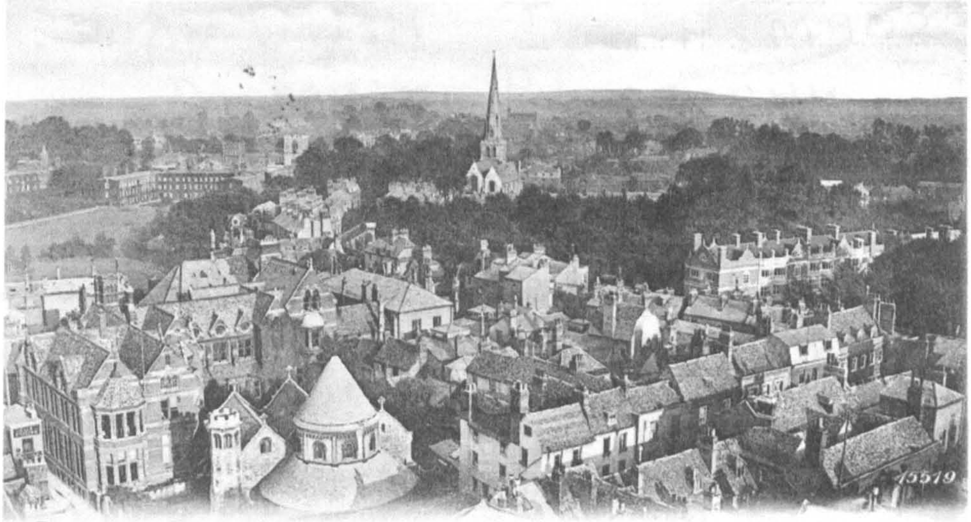

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Abstract

"Aspects of Infant Mortality in a University Town: Cambridge 1875-1911".

As part of a wider Open University project investigating the decline in infant mortality, 1875-1948, this thesis takes the form of an examination of two propositions. First, that the chance of infant survival was determined more by environmental characteristics than by personal and family characteristics. Environmental characteristics include social characteristics and in particular the role played by members of the University. The second proposition was that the development of a health visiting service was a major contributor to the decline of infant mortality in Cambridge after 1906. The impact on infant mortality on five areas of infant and family life is investigated. These include personal characteristics and family income, the external environment, the state of housing, philanthropic ventures and the provision of a health visiting service. These areas were explored in the light of the work of others and this work contributes to the debate on the timing of the decline in infant mortality by investigating the influence of various factors at micro level. The Vaccination Birth Registers, the Medical Officer of Health Reports and the work of the early twentieth century investigators are used. The Vaccination Birth Registers allow detailed investigation at street level in the first three months of infant life. It was found those environmental factors and personal and family characteristics played an important part in the chance of an infant surviving the first year of life. Personal factors were particularly important in the first three months of life. Although evidence suggests that members of the University and those of the town lived separate lives they worked together in philanthropic initiatives which had a positive effect on the health of infants. In particular by establishing a health vesting service, the evidence suggested a positive relationship between the work of health visitors and the reduction in infant mortality from diarrhoea.

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Index of Contents

Index of tables

Index of tables contd.

Index of tables contd.

Index of tables contd.

Index of tables contd.

Index of charts

Index of Figures

Index of Maps

Chapter 1

Introduction

This thesis is part of a wider Open University project investigating the decline in infant mortality. Despite life expectancy increasing sharply throughout the late nineteenth century levels of infant mortality remained high. By the beginning of the twentieth century the infant mortality rate (IMR) in England and Wales was 150 deaths per 1000 live births, a level it had maintained since at least the onset of the civil registration of births, deaths and marriages in 1837 (Woods and Shelton, 1997, Fig.12: 48). At the end of the twentieth century the IMR was only 6 deaths per 1000 live births (Office for National Statistics, 2001). There is debate surrounding both the timing of the start of the decline in infant mortality and the factors bringing it about.

Two articles from the late 1980s, by Woods, Watterson and Woodward (WWW), whilst not the start of recent discussions provides a convenient starting point for this investigation. The first article sought "to present a detailed demographic analysis of the pattern of infant mortality variation over time and through space, by type of environment and social class." It concluded that infant mortality fell sharply in most European countries only from the beginning of the twentieth century whilst the mortality rate for 4 to 9 year olds had steadily declined from the 1860s onwards (WWW, 1988). Why infant mortality lagged behind the mortality decline of other age groups forms the basis of much historical research on the subject of infant mortality and is the subject of this thesis.

The second article aimed at providing an explanation for this changing pattern of infant mortality and in particular the origin of its secular decline (WWW, 1989: 129). Early twentieth century contemporary analyses of the problem of infant mortality were used by WWW, in particular the reports of Sir Arthur Newsholme, Chief Medical Officer of the Local Government Board and the work of Sir George Newman. In this second article WWW concluded that whilst infant mortality fell across the country its fall was more precipitous in urban than in rural areas, regardless of region or social class (WWW, 1989: 129). Neonatal mortality rates remained relatively constant whilst post- neonatal rates, although fluctuating from year to year, were responsible for the first stages of the decline. Lee, however, whilst admitting "there was no doubt that after 1901 the downturn (in infant mortality) was both universal and substantial", argued that the pattern of change at the national aggregate level covered a diversity of regional patterns, especially during the late nineteenth century (Lee, 1991: 59).

It was also argued by WWW that an increase in infant mortality in the 1890s was due to climatic conditions favourable to the spread of epidemic diarrhoea and if these were discounted then the secular decline in infant mortality started in the late 1880s. Others have argued that the beginnings of the decline can be traced as far back as the 1860s (Williams and Galley, 1995). Breast feeding, the improved quality of milk and other foods, the education of women, the availability of professional advice, the decline of fertility and the role of the "health of towns" movement were, argued WWW, all important in initiating this decline (WWW, 1989: 129-131). They were not, however, able to prioritise these different factors.

The findings of WWW have subsequently been tested by others. Williams and Galley reviewed both papers and identified the importance of geography showing that the county level estimate diluted the rural urban differences (Williams and Galley, 1995: 403). Garrett and Reid found that where one lived strongly influenced chances of survival and that industrialised urban areas were less healthy than other urban areas (Garrett and Reid, 1994:167). Although nationally aggregated data indicate an abrupt decline in infant mortality in the first decade of the twentieth century, historians have argued that this hides the true picture. High levels of infant mortality in towns and cities with lower levels in rural areas had been widely reported (Newman, 1906; Ashby, 1915; WWW, 1988: 351-353; Williams and Galley, 1995; Woods and Shelton, 1997). It was the high infant mortality rates of the growing populous areas that kept the national IMR high (Williams and Galley, 1995). The size of the town did not, however, always indicate the level of infant mortality, as the IMR of some smaller towns was higher than that of some of the larger cities and towns (Woods, Williams and Galley, 1993). Williams and Mooney suggested that this was probably because lower levels of sanitary arrangements existed in these smaller towns leading to an increase in infant mortality from diarrhoea (Williams and Mooney, 1994: 196).

Despite the debate surrounding both the timing and the factors involved in the decline in infant mortality there is agreement amongst historians that any investigation should, rather than focussing solely on the period around the turn of the nineteenth to the twentieth century, look at infant mortality over a longer time span because, as shown above the urban/rural timing of the decline differed thus differing factors were involved at different times. To that end, infant mortality in Cambridge, England over the 1871 to 1911 is the subject of this thesis.

The thesis aims to examine two propositions. First, that the chance of infant survival was determined more by environmental characteristics than by personal and family characteristics. The environment versus class argument is the central tenet of a major contribution to the debate (Garrett, Reid, Schürer and Szreter, 2001). Garrett *et* al use four basic environments, agricultural, white collar, light industry and staple industry in their investigation and the social class is determined by occupation of head of household (Garrett, Reid, Schürer and Szreter, 2001: 140-141). For the purpose of this thesis the definitions of these characteristics have been refined somewhat. First of all, personal characteristics are expanded to embrace, on the one hand, certain "characteristics" specific to each infant. e.g. date of birth, gender, congenital conditions, whether a singleton birth or not, and whether born prematurely or not; and, on the other hand, the medley of characteristics associated with the social class of the child's father or, in the case of an illegitimate born infant, of the mother, which will be termed "family characteristics". Environmental characteristics refer to the sanitary environment, sewage removal, pure water and removal of refuse. Also included in 'environmental characteristics' is the 'social environment' in particular the part played by members of the University and town elites. The state of housing is considered to be an environmental characteristic but the house in which a family lived was dependent on family income a 'family characteristic'.

The second proposition is that, after 1906 when health visiting was established in Cambridge, the development of a one-to-one relationship between health visitors and the mothers of newborn children was a major contributor to the decline of infant mortality. The first health visitors to be employed worked in Manchester and they started work in 1892. In Cambridge health visiting was established in 1906 as a result of members of the University working with members of the town elite. The role played by members of the University is explored in Chapter 8. There is debate amongst historians as to the contribution of health visiting to the decline in infant mortality. It is argued by some that because health visiting was by no means a universally provided service then the national decline in infant mortality would not have been attributable to the activity of health visitors (Lewis, 1980. Mooney, 1994). Reid, on the other hand, argued that when the service was targeted towards families experiencing factors which were generally linked to higher mortality then the health visitors contributed towards lower infant mortality (Reid, 2001). Other historians argued that the educative function of health visiting failed because health visitors were not welcomed by mothers

(Dyhouse, 1978). Others argued that when the advice was well received the educative function was effective (Dwork, 1987. Szreter, 1988). These debates are further pursued in Chapter 9 where the evidence of a near universally provided service in Cambridge will be explored.

The contribution of health visiting will also be assessed by the tasks undertaken by health visitors, according to the four principles underpinning modern health visiting practice. 1) Working with families to collect data for analysis to search for health needs. 2) Stimulating and raising awareness of health needs with families. 3) Influencing policies affecting health and acting as a pressure group. 4) Facilitation of health enhancing activities such as breast feeding and safe feeding practices. (CETHV, 1977; CETHV 1980; CPHVA, 1992 and 2002). The success or otherwise of these tasks was dependent on the health visitors establishing a one to one relationship with the mother.

Factors influencing infant mortality

Infant mortality has been referred to as a "hydra headed evil" because of the multiplicity of factors that influence the health of an infant (Pooler, 1918: 7). The way in which health is viewed determines what factors are considered to influence ill health and result in death. The medical model views health as the absence of a detectable abnormality of the body and illness as symptoms felt e.g. aches and pains, or loss of function but does not encompass the concept of wellbeing. This western scientific medical model of health is very narrow and negative, defined by **what health is not** rather than **what it is**. On the other hand the social model of health will be used in this investigation because it encompasses all factors that could influence the health of an infant. "The social model of health recognises that health is an outcome of the effects of all factors affecting the lives of individuals, families and communities in different ways and through different pathways (Hooper & Longworth: 19)".

In the late nineteenth century there is some evidence that certain commentators had embraced the social model of health. Newsholme, for instance, wrote five detailed reports on the problem of infant mortality, in 1910, 1913, 1914, 1915 and 1916, whilst Newman devoted an entire book to it in 1906, entitled *Infant mortality - a social problem*. In the first of his reports Newsholme listed the factors influencing the variation in infant mortality rates in urban and rural areas. These are reproduced here (Table 1.1) in the summary version produced by WWW (1989: 114).

Table 1.1: Factors influencing infant mortality according to Sir Arthur Newsholme

Mother	**Care of mother**	**Care of child**	**Poverty**	**Housing**	**Sanitary environment**
Age	Ante natal	Delivery	Housing	Type	Pure water
Work	Post natal	Advice	Unemployment	Crowding	Excreta disposal
Family size	Maternal mortality	Method of feeding	Mother working		Scavenging
Illegitimacy			Children working		Paving

Source: Woods R. Watterson P. A. and Woodward J.H. 1989: 114.

As well as the individual care an infant received Newsholme also considered the wider social factors of poverty, housing and the sanitary environment as relevant to the health of an infant. Sir George Newman, a contemporary of Newsholme, placed a great emphasis on the role of motherhood in the health of infants. This included what he called the 'education of the mother as to infant management' (Newman, 1906: 262). He noted that 'few facts receive more unanimous support from those in intimate touch with this question than the ignorance and carelessness of mothers in respect of infant management. Death in infancy is probably more due to such ignorance and negligence than to almost any other cause' (Newman, 1906: 262).

Woods used a model made up from variables that he believed influenced the general level of nineteenth century mortality (Woods, 1982: 392). His model suggests that industrialisation led to environmental and socio-economic changes. Society responded to these with sanitary reforms and improvements in health care and to the standard of living. Williams and Galley also produced a model, using four categories of factors which, they argued, affected infant health in the nineteenth century. The four categories were economic, environmental, political/industrial and social/behavioural (Williams and Galley, 1995: 417-8). The factors in both these models are similar to those in Table 1.1. Thus it would seem that there is a general agreement on which factors influence infant health when health is defined using a social model.

Factors influencing infant health and the investigation into the two propositions set out above.

The propositions will be examined in the light of the contribution of the various factors agreed as influencing infant health in the context of the University town of Cambridge, England.

For the purpose of the investigation into the proposition that the chance of infant survival was determined more by environmental characteristics than by personal and family characteristics the following factors will be considered:-

Personal and family characteristics

Age of infant, gender and hereditary factors

Parental occupation

Housing and living conditions

Environmental characteristics

General socio-economic, cultural and physical environmental conditions

Housing

Social and community influence including the part played by members of the University

Personal and Family Characteristics

Research into the personal factors linked to the infant and to the social standing of the family, proxied by the occupation of one parent, is limited by the availability of the Vaccination Birth Registers and time to research other sources such as Census data. In this thesis most of the archival material is drawn from the Cambridge Collection at the Cambridge City Library and the County Record Office, Shire Hall, Cambridge. Both house valuable archives related to Cambridge and relevant to the study of infant mortality (further discussed in Chapter

2). The most important of these are the Vaccination Birth Registers, which are located in the County Record Office, and are a largely untapped source of information on this topic. They were partial copies of the civil birth registers and as such gave detailed information about the infant and its parents.

Gender, legitimacy, and multiple births have all been shown to have a major influence on infant mortality (Reid, 2001). The neonatal period and being born male are factors that have been identified by a number of researchers as risk factors for infant mortality (Naeye, Burt, Wright, Blanc and Tatter, 1971; Woods, Williams and Galley, 1995; Reid, 2001). Reid investigated neonatal and post-neonatal (infants over 28 days of age) infant deaths using a valuable and rare resource - health visitor ledgers - for Derbyshire, for the period 1917-1922. She found that in the peri-natal period, defined as infants under seven days of age, demographic and maternal influences were important whereas in the neo-natal period the influences on infant mortality were numerous and operated at a variety of different but interconnecting levels (Reid, 2000). In chapters 3, 5 and 7 data in the Cambridge vaccination registers is used to explore differences in infant mortality by place of birth, gender, illegitimacy, parental occupation, age at death and season of death. In Derbyshire Reid found a seasonal aspect to infant mortality with children born in the winter months being found to have a greater risk of death in the neonatal period than those born in the summer months (Reid, 2001). Date of birth of the infant, which is given in the Vaccination Birth Register, coupled with the date of death, allows this seasonal aspect of infant mortality to be explored for Cambridge (see Chapter 10).

The Cambridge Vaccination Registers do not give cause of death. The Medical Officer of Health Reports for the town do, however, supply aggregative information on infant deaths from a variety of diseases and are available for the years covered by this study. They are described in more detail in Chapter 2.

In cases of need family income can be increased by mothers who carry out paid work both inside and outside the home. In the late nineteenth and early twentieth centuries it was widely, though not universally held that such mothers must necessarily have neglected their babies, especially in the all-important role of breast-feeding. It was argued that by taking on paid employment the mothers increased the risk that their children would die prematurely (Dyhouse, 1978: 251). Not surprisingly then, the Interdepartmental Committee on Physical Deterioration, which reported in 1904, recommended that the employment of mothers should be discouraged. The validity of this argument has been questioned because, it is claimed, the middle class observers who wrote accounts of Victorian working class life revealed more about the prejudices of the middle classes as to the role of mothers, than about what working class life was really like (Dyhouse, 1978: 262).

Szreter (1996) quotes a 1908 study by Robertson, MOH in Birmingham, which Szreter argued was methodologically thorough because the home conditions experienced by families where a wife worked and where she did not work did not differ. All the babies born in two uniformly depressed areas of St. George's and St. Stephen's were visited and the infants weighed throughout the first year of life. The average income of families where a mother stayed at home was twenty-one shillings. In families, when the mother took paid employment the average income was twenty three shillings. Although the infants of women who worked weighed less over the first year of life, because breastfeeding was discontinued early, the impact of both breast-feeding and the mother working was minimal when compared to that of poverty. Robertson found that where the wife worked infant mortality was lowered because she brought in extra income. Dr Jessie Duncan confirmed these findings the following year; the general conclusion being then that infant mortality was lowered when a mother worked (Szreter, 1996: 244-45). In Cambridge the role of mothers who work will not be explored as the vaccination registers only give details of the mother's occupation in those cases where a child was illegitimate.

Environmental characteristics

Where a family lives and the type of house owned or rented is in part determined by the family's income and in part by the number of its members. Larger families need larger houses, so if family income is small, they must put up with cheaper, and consequently poorer quality, accommodation. Housing is the subject of Chapter 7.

Using *individual* anonymised records from the 1911 Fertility census it has been shown that survival through infancy was influenced more by where a family stayed than by the social status of parents (Garrett and Reid, 1994: 167; Reid, 1997: 151). This ran counter to the findings of other researchers using the *aggregate* results of the 1911 Fertility census which suggested that the child's chance of survival was especially influenced by the occupation its father followed (Watterson, 1988;

Preston and Haines, 1991). The Cambridge Vaccination Birth Register data, unlike the 1911 census material, is not anonymised allowing more detailed investigation of individual and community characteristics. However, as noted earlier, the Vaccination Birth Registers only gave information on an infant's death if this occurred before vaccination. Methods of calculating mortality measures are discussed in Chapter 2, in particular the constraints imposed by the Vaccination Birth Register data, and how these can be minimised.

The environmental influences associated with where an infant lived were important, particularly when considering respiratory disease, as Reid found in the densely populated mining areas of Derbyshire (Reid, 2002: 163). They also played a part in the spread of summer diarrhoea (Buchanan, 1985; Hardy, 1993; Szreter, 1988). The physical environmental infrastructure in the community included sewerage systems, the provision of water, paving, and scavenging etc. The infrastructure outside the home applied to all families living in the area but was modified by those factors that pertained to individual families, particularly family income. For example although, in the early twentieth century, an effective sewerage system may have been in place, a working class family may not have been able to afford to rent accommodation connected to the system.

Garrett *et al* identified four basic "environments": agricultural, white collar, light industry and staple industry. These environments were as much a measure of 'social' factors as 'physical'. Agricultural labourers, for instance, were more poverty stricken than industrial labourers and although they were likely to have had few of the urban amenities of sewerage and piped water, lighting, paving or scavenging, their infant mortality rates were very low. This suggested that the relationship between infant mortality and income, environment and social class was somewhat more complex than suggested hitherto (Garrett *et al*, 2001: 139).

Although Cambridge was a market town with a largely agricultural hinterland it was also a University town with a local economy heavily dependent on the University. The University provided a considerable number of service jobs, especially in term time, whilst building and maintenance work was required throughout the year. The town had no staple industries; the largest occupational group, as recorded in the Vaccination Birth Registers being that of labourers who were mainly working in the building trade or service sector (Cambridge Borough Vaccination Birth Registers, 1905-1911). However this finding should be approached with caution since the fertility rate of families headed by labourers may have been higher than that of those headed by other occupational groups (Garrett *et al*, 2001: 290 Table 5.7.1).

In the light of the findings of Garrett *et al* (2001), one would expect Cambridge to have had a relatively low infant and child mortality rate, certainly when compared to the industrialised towns. Evidence from the 1911 Fertility Census Report and Fifty Second Annual Report of the Local Government Board for 1912-13 suggests this was indeed the case (Table 1.2).

Table 1.2: Standardised child mortality rate per 1,000 births, for the urban and rural portions of selected counties, 1911

County	Urban	Rural	% difference
Cambridgeshire	139	114	22
Middlesex	139	134	4
Kent	140	122	15
Oxford	126	107	18
Buckinghamshire	129	113	14
Derbyshire	177	162	9
Durham	202	199	1.5
Lancashire	202	156	29

Source: 1911 Census of England and Wales, 1923, Vol. XIII, *Fertility of Marriage*, British Parliamentary Papers, (1923) (Part II), Table LIII, pp. cxxii-cxxvi.

Table 1.2 shows that on the whole child mortality was higher in urban areas than rural areas, the greatest difference being in Lancashire where it was 29% higher in urban areas than in rural areas, Cambridgeshire experienced the next greatest difference, 22% higher in the urban area than in the rural area. Relative to the urban/industrial areas the child mortality rate in Cambridge was low. When compared to the rural areas of the county of Cambridgeshire it seems relatively high particularly when a comparison is made with urban and rural areas of Oxford and Buckinghamshire. Since the experience of child mortality in the three rural areas was similar then this suggests that Cambridge was unhealthy in comparison to similar urban areas.

The second proposition that, after 1906 when health visiting was established in Cambridge, the development of a one-to-one relationship between health visitors and the mothers of newborn children was a major contributor to the decline of infant mortality will be examined in the light of the following factors:-

Social and community influence

Influence of members of the University.

The influence of philanthropic activity

The influence of health visiting on infant feeding

Social factors and the influence of the University

Members of the University worked with members of the town elite to improve the health of infants living in Cambridge, philanthropic initiatives established by them included health visiting and other infant welfare services. The establishment of a health visiting service in Cambridge in 1906 was the charitable response to infant mortality. Two local women were employed as health visitors under the supervision of two lady superintendents, both qualified nurses, working in a voluntary capacity. Craig's study in Cambridge found that the influence of medical people was important in establishing health visiting and the provision of uncontaminated milk for infants (Craig, 1994). In Chapter 8 it will be shown that the presence of the University in the town was important in tackling the problem of infant mortality in the town and that members were crucial in the development of initiatives which played a major part in improving infant health.

Health visiting and infant feeding

To demonstrate that the work of the health visitors was effective in bringing about an improvement in infant health is not easy, for even today it is felt by some that "one of the main challenges for health visitors is to demonstrate that their work is effective" (Wain and Shuttleworth, 2000:

72; see also DHSS, 1983; Luker, 1992; Barriball and Mackenzie, 1992: 207-212; Audit Commission, 1994; Campbell, Cowley and Buttigieg, 1995).

It has been argued that, at the beginning of the twentieth century, health visiting was by no means universal and the number of mothers who were visited by a health visitor was low, so that the impact on infant mortality generally cannot have been large (Lewis, 1980). However, Reid states that this argument ignores the reason why the families had contact with health visitors. She argues that the families visited were more likely to experience factors that raised infant mortality than did their more affluent neighbours (Reid, 2001). Using the Cambridge data it will be shown that the early twentieth century health visitors did in fact visit the majority of mothers in Cambridge and were therefore in a position to bring about changes in infant feeding practice in the town.

Mooney used the number of visits and repeat visits made by London health visitors to measure the effectiveness of health visiting in the first decade of the twentieth century. He determined the quality of the advice given by the level of training the health visitor received (Mooney, 1994: 158). In Chapter 9 the number of visits and repeat visits made by Cambridge health visitors will be compared with Mooney's findings, as will their level of training. This will show that, in Cambridge a higher percentage of women were re-visited by the health visitor than were visited in London. The number of re-visits provided evidence that the Cambridge health visitors had more time to establish a one to one relationship with mothers thereby increasing the likelihood of positively influencing infant feeding practices. Fildes states "studies of infant mortality in both historical and modern populations from around the world have shown that the most important single factor affecting infant mortality rate is the way in which babies are fed" (Fildes, 1998: 251).[1]

Breast-feeding is associated with a reduction in cases of gastro-enteritis and respiratory disease (Howie *et al,* 1990; Wilson *et al,* 1998).[2]

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[1] The overall decline in mortality was long held to be the result of rising real incomes that led to an improved diet and gradual rise in living standards (McKeown, 1979). This explanation has been widely challenged. The analysis of the empirical data has been claimed to be misleading and the public health movement rather than nutritional improvements said to be the true moving force behind mortality decline (Szreter, 1988). Guha put forward a critique of this alternative interpretation (1994). Szreter responded by arguing that Guha had not mobilised an effective case and that subsequent contributions to the debate had further diminished the strength of the McKeown thesis (Szreter, 1994). It should be remembered, however that the McKeown thesis dealt with mortality in general rather than infant mortality specifically. It could well be argued that the nutritional status of a pregnant woman can impact on the development of the foetus and through it on to the subsequent development of the child. Furthermore a badly nourished mother is less likely to be able to provide breast milk in sufficient quantities or of a satisfactory quality.

[2] An infant feeding study was carried out in Dundee from 1983-1986 (Howie *et al,* 1990) and the same cohort of infants were followed up in the period 1990-1993 to investigate the relation of infant feeding practice to childhood respiratory illness, growth, body composition and blood pressure. It was concluded that the probability of respiratory illness occurring at anytime during childhood was significantly reduced if the child was fed exclusively on breast milk for at least 15 weeks (Wilson *et al,* 1998).

It was and still is promoted as the optimal choice for feeding infants, with the well-known slogan "Breast is Best" being used by Medical Officer of Health in Cambridge in the early twentieth century (MOH report, 1909). The main food for infants is milk and for those mothers unable or choosing not to breast feed, the cleanliness of alternative sources of milk was and is a factor in the transmission of infectious disease. It has been shown that in early twentieth century USA artificial feeding was associated with infant mortality three to four times higher than that experienced by breast-fed infants (Woodbury, 1922: 686). Closer to home, Morgan has argued in a recent article, that an explosive growth in the number of horses in Preston, Lancashire in the late nineteenth century was responsible for an increase in the number of flies and a consequent rise in the contamination of milk leading to higher levels of infant mortality (Morgan, 2002). The hazards associated with the use of contaminated milk and feeding equipment led to clean milk initiatives being set up, this included information being given by health visitors and the establishment of milk banks (both dealt with in more detail in Chapters 8 and 9). Clean milk initiatives included hygienic collection, preparation and distribution of milk from cows pronounced healthy. The milk was put into bottles ready to feed the infant and distributed through milk depots (for more detail see Chapter 9).

By the second decade of the twentieth century dried milk produced especially for infants was available at infant consultation centres. The role played by cows' milk and its relative importance in the decline in infant mortality is, however, disputed. On the one hand Beaver argues that cow's milk has played an important part in the progress of public health and that the reduction of infant mortality at the start of the twentieth century was associated with an improvement in the quality of milk (Beaver 1973: 254). On the other hand, whilst not disputing the importance of attempts to supply pure milk solely for infant feeding, Dwork argues that without domestic hygiene education the initiative had limited usefulness. Only if the distribution of clean milk was combined with advice from health visitors and voluntary workers would a significant and permanent improvement in infant welfare result (Dwork 1987: 69). Unfortunately, in Cambridge, no records of how individual infants were fed survive but the Medical Officer of Health did record the numbers of infants breast fed and artificially fed, in addition the mortality rate from diarrhoea for each method of feeding is given. This makes it possible to investigate the impact of the chosen method of infant feeding on infant mortality and the part played by the health visitor in encouraging breast feeding or safe feeding practices in the case of artificially fed infants.

This will contribute to an assessment of the health visitor's role in reducing infant mortality. (Chapter 9).

Conclusion

Research at the national level has shown that infant mortality began a secular decline in the first few years of the twentieth century. However research at the regional and local level has established that the timing of that decline varied across the country, most notably between rural and urban areas. Historians have investigated the relative importance of the factors associated with this decline. Their work has been remarked upon in this chapter in the context of the two propositions central to this thesis.

First, that the chance of infant survival was determined more by environmental factors than by personal and family characteristics. It will be argued that although personal characteristics of the child itself (male or female, date of birth, singleton or not) and those of the parents (principally occupation and the features which result from that) are of key importance in determining a child's risk of dying during its first year, the domestic and extra-domestic environment in which an infant lived was of even greater importance in this regard.

As was social and community influence particularly the part played by the University and town elites. It has been shown that a number of historians have engaged in the environment versus class debate especially as regards neonatal and post neonatal mortality.[3]

The second proposition that will be investigated is that, after 1906 when health visiting was established in Cambridge as a result of philanthropic activity initiated by members of the University, the development of a one-to-one relationship between health visitors and the mothers of newborn children was a major contributor to the decline of infant mortality. The importance of breast feeding and safe artificial feeding will be investigated as will the part played by health visitors in influencing feeding practices.[4] As few health visitor records have survived it has proved difficult to assess their impact. Reid, as noted above, has worked with one valuable source in Derbyshire. Although no surviving health visiting records have been located in Cambridge there is a complete run of Vaccination Birth Registers from the time when health visitors were first employed. From these, valuable statistical information can be

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[3] Watterson (1986), Williams (1989), Williams and Mooney (1994), Garrett and Reid (1995), Williams and Galley (1995), Reid (1997) all engage with this debate.

[4] Howarth (1905), Beaver (1973), Dwork, (1987), Howie *et al* (1990), Atkins (1992), Fildes (1992 & 1998), Woods and Shelton (1997), Wilson *et al* (1998), Reid (2002) have all debated the role played by breast and artificial feeding in infant survival.

derived which, as is shown later in this thesis, lends itself especially to the exploration of the "personal and family characteristics" part of the debate. The Cambridge Collection houses a vast range of material some of which has also been used to explore the "environmental characteristics" part of the debate.

The Cambridge MOH reports will be used to gather information on infant mortality in the time period under investigation. A more detailed investigation will be pursued from 1905 onwards using the Vaccination Birth Registers, a previously untapped source. These registers provide data related to the personal and family characteristics of infants born in Cambridge from 1905 onwards. The date of death of any infant who subsequently died before immunisation is linked to the birth details in the Vaccination Birth Register. These findings will be used in combination with findings from other archival sources of information and relevant recent research in order to investigate the impact of the following five areas of infant and family life on infant mortality.

1. Personal characteristics and parental occupation

2. The external environment, particularly sanitation and provision of clean water.

3. The state of housing or the 'internal' environment e.g. sanitary arrangements, access to clean water, state of repair of housing and overcrowding.

4. Social environment including how the University and the elite of the town worked together on philanthropic ventures aimed at improving the health of the townspeople.

5. The development and provision of a health visiting service.

Table 1.3 gives an indication of the Chapter in the thesis in which specific factors are discussed in detail.

Table 1.3: The factors influencing infant mortality

Personal and family characteristics		
Factors influencing the health of infants	**Title of chapter**	**Chapter**
Age, sex and hereditary factors of the infant	"Infant Mortality" "Cause of death"	4 5
Parental occupation which determines living and working conditions	"Housing"	7
Environmental characteristics (including social characteristics)		
Factors influencing the health of infants	**Title of chapter**	**Chapter number**
General socio-economic, cultural and environmental conditions. (Physical environment)	"Cambridge in the 19th and early twentieth century" "Environmental factors: the role of public agencies"	3 6
Living and working conditions (generally determined by parental occupation)	"Housing"	7
Social and community influence	"The influence of philanthropic activity"	8
The influence of health visiting practice		
Factors influencing the health of infants	**Title of chapter**	**Chapter**
Social and community influence	"The influence of philanthropic activity"	8
Individual lifestyle factors	"Health Visiting and infant feeding"	9

The findings from the investigation of the five factors will then allow the following four central questions, related to the two propositions, to be addressed.

1. How do "personal and family characteristics" impact on the chance of an infant dying during its first year?
2. How do domestic circumstances and the physical environment impact on an infant's life chances?
3. What was the role of the University and town elites in influencing infant mortality?
4. How did health visiting, through its impact on both "personal and family characteristics" and "the environment in which an infant lived" impact on an infant's health?

Chapter 2: Sources and Quantitative Methods

Introduction

In this chapter the strengths and weaknesses of the main primary sources used in this thesis are evaluated as regards both their reliability and limitations. Since primary sources of information were originally created to fulfil the needs of the time they may present problems for those using them for other purposes. It must always be remembered that they were not 'created to satisfy the curiosity of future historians' (Marwick in Drake and Finnegan, 1994: 18). The sources used for the current research were generally contemporary with the period they documented; they were 'first hand' accounts. For example the local Vaccination Birth Registers, the Infant Death Registers and the Vaccination Officer's Report, which can be located at the County Record Office, Shire Hall, Cambridge, were used to ensure that infants were vaccinated against smallpox. Here they have been used to advance our understanding of infant mortality by linking the birth and death of an infant to its place of birth, the household in which it was born, the occupation of its father or mother, the timing of its death and so on. Finally methods of calculating infant mortality are discussed.

Smallpox and the Vaccination Birth Registers

Smallpox was a major cause of death throughout the 18th century and much of the 19th. The number of deaths varied from year to year, but in some years (e.g. 1796) it is said to have accounted for as many as 184 out of every 1,000 deaths (Corfield, 1897: 227). Smallpox was caused by the variola virus, which infected internal organs and caused severe blistering of the skin. The outcome was often death from blood poisoning or secondary infection. In 1721 Lady Mary Wortley Montagu introduced variolation into England. This was a form of inoculation with the contents of the smallpox lesions from an infected person. Lady Mary, wife of the British Ambassador to Turkey, had her own child successfully inoculated and it was her experience that led to members of the British Royal Family doing likewise. The idea of variolation was that by introducing the pustular contents of the smallpox lesions the inoculated person would contract a mild form of the disease and develop immunity to smallpox. This form of inoculation was not always successful as some of those inoculated succumbed to a severe case of smallpox from which they died. Furthermore they could infect others (www.schoolscience.co.uk).

The modern practice of vaccination was developed from the work of Edward Jenner, a surgeon and country doctor. He was intrigued by country folklore which involved the belief that people who caught cowpox (vaccinia) could not catch smallpox.[1] In 1796 Jenner deliberately infected an eight year old boy, James Phipps, with cowpox. He used pus from the lesions of a milkmaid suffering from cowpox. Although the boy became ill from cowpox he recovered and when Jenner later infected the boy with smallpox he did not contract the disease. Following many more successful vaccinations the results of Jenner's work were published in 1798. Despite the success of vaccination some doctors continued to practice the relatively dangerous procedure of variolation until it was banned under the Vaccination Act of 1840 (www.schoolscience.co.uk). It was not until 1853 that the vaccination of all infants was made compulsory throughout England and Wales and not until 1871 that a mechanism was in place to ensure - at least for a decade or more - that virtually all infants were vaccinated. The effect was startling. In 1838 some 30,819 people died from smallpox. By 1890 that number had fallen to 15 (Galton, 1892: 371). In relative terms, deaths from smallpox fell from 576 per million persons in 1841 to just 20 per million in 1891-95 (Fayrer, 1898: 344-345). Today we understand how active immunity is gained, either by having the disease or from vaccination. Vaccines that contain a weakened part of the

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[1] Cowpox is a mild viral infection of cows causing a few weeping spots on the cow's udders. Milkmaids occasionally caught cowpox from the cow and although they were off colour for a few days and developed a small number of spots on the hands the infection did not trouble them (www.jennermuseum.com).

disease-causing organism, as Jenner's cowpox vaccine did, trigger the immune system to produce antibodies against the disease. If the vaccinated person comes into contact with the disease itself then the virus is recognised and antibodies are rapidly produced to combat it.[2] In the early nineteenth century the working of the immune system was not understood. It was not, therefore, surprising that people were fearful of a vaccine derived from infected animals or people suffering from a disease caught from cows. This was despite smallpox being a disease to be feared, having for example caused one fifth of all deaths in Glasgow at the end of the 18th century (The Scottish Office NHS Policies for Children, 1999).

Vaccination Birth Registers

The civil registration documents are not available for public consultation, although copies can be purchased. The Vaccination Birth Register, being a copy, is then the only source for investigating infant mortality at the level of the individual. As these are a central feature of this study, marking it out from studies dependent upon aggregative data provided by the Registrar General, the Vaccination Birth Registers are of crucial

[2] Specifically B-lymphocytes and T-lymphocytes recognise antigenic material to which they have become primed and thus initiate an immunogenic response; this is known as immune memory (CPHVA and RCN, 2004: 29).

importance. The 1853 Vaccination Act made vaccination compulsory for all infants, but provided no measures for enforcing this. Gradually, Acts of Parliament in 1861, 1867 and 1871 tightened enforcement (Drake, 2005:37). The Vaccination Acts provided legislation for the appointment of public vaccinators to carry out vaccinations and for vaccination officers to ensure the legislation was complied with. The 1867 and 1871 Acts required that every child be vaccinated before it was three months old, or at the next public vaccination session after the infant had reached that age. The Vaccination Birth Registers were created in order to help monitor the vaccination of infants. The registration of Births, Marriages and Deaths began in 1837 and the Vaccination Birth Registers were, in effect, a copy of the register of births. The Vaccination Officer who received the requisite information from the local Superintendent Registrar of Births, Marriages and Deaths made the entries in the Vaccination Birth Register. England and Wales had been divided into Registration Districts and Sub-Districts. These were based on the Poor Law Unions that had been set up in 1834. The registrar for each sub-district collected the details of births, marriages and deaths that occurred in the district for which he was responsible and these were then sent to the Registrar General's Office in London where they were copied and indexed. When a birth was registered the person registering the birth was given a notice of requirement of vaccination. This gave the name of the public vaccinator and the time and place when vaccination was to be carried out. When the infant was taken for vaccination the notice of requirement of vaccination was given to the public vaccinator, who, when the vaccination was successfully completed forwarded the notice to the vaccination officer. A private doctor could vaccinate an infant if its parents so wished. In this case it was the duty of the parents to return the notice of vaccination to the vaccination officer. A week after vaccination took place the public vaccinator inspected the site of the vaccination to ensure that it had been successful and then a certificate of vaccination was given. If unsuccessful a certificate of 'insusceptibility' was issued. In effect this meant that the infant had already developed immunity to the disease. These details were recorded in the Vaccination Birth Register (Figure 2.1). The Vaccination Officer also received lists of infant deaths from the Registrar and if a death occurred before vaccination it was recorded in the Vaccination Birth Register. These lists of deaths, which have generally survived in far fewer numbers than the Vaccination Birth Registers, gave all infant deaths and not just those of infants who died before vaccination (Figure:2.2).

I *Extract from* the Register Book of Births relating to each child							II Minutes of notice given pursuant to 30 and 31 Vict. C. 84. s. 25		Register of Certicates				IV Date of death in case of child being dead before vaccination	V Reference to consecutive number in the Officer's Report Book in cases transferred thereto
1	2	3	4	5	6	7	8	9	I	II	III	IV	V	VI
No in Birth Register	When born	Where born	Name, if any, of child	Sex	Name and Surname of the Father, or (if the child be illegitimate) of the Mother	Rank, Occupation or Profession of parent	When given	To whom given	Date of medical certificate of *successful* Vaccination	Date of *Certificate of* Insusceptibility or *of having had* Small Pox Ins' or '*S.P.*' as case may be	Name of *the* Medical Man by whom the Certificte is Signed	Date of Certificate under Sec. 2 of the Vaccination Act, 1898		

Figure 2.1 Vaccination Birth Register

Extracts from Register Book of Deaths relating to each child									
No. in Death Register	When Died	Where Died	Name and Surname of infant	Sex	Age	Name and Surname of the Father, or (if the child be illegitimate) of the Mother	Rank, Occupation, or Profession of Parent	No. in Birth Register if registered in this Sub- District, and the Register is in possesion of the Registrar	Remarks
1	2	3	4	5	6	7	8	9	10

Figure 2.2: Infant Death Register

Taken together the two registers allow, through the process of nominal record linkage, the calculation of infant mortality rates in a variety of ways. For instance it is possible to undertake calculations for various age groups (under one week, under one month), for various areas (groups of houses, streets), by the social class of father (in the case of children born inside marriage, of mother if born outside), and so on. The range of calculations is reduced if only the Vaccination Birth Registers are available. However, even then it is still possible to calculate rates for children who died during the first 90 days or so of life, when coverage of deaths was virtually complete in the Vaccination Birth Registers - few children were vaccinated before this. As some two-thirds of infants who died did so in the first few weeks of life a great deal of infant mortality is covered. The major drawback of both registers is that they do not provide cause of death.

The Vaccination Acts did allow vaccination to be delayed if the child was not in a fit state to receive it, the reasons being recorded in the Vaccination Officer's Report Book. The reason for the delay was not always made explicit, for instance, the terms 'weakly' and 'poorly' often being used. Eczema could be offered as a reason for the delay and remained so until the end of the smallpox vaccination programme in 1965.

Cambridge Registers

Cambridge Vaccination Birth Registers are available for the years 1885 (incomplete) and 1905-1931. Registers for each of the intervening years have not survived. The Cambridge Vaccination Birth Registers will be used in this investigation to provide statistical information on infants born in the period 1905-1911 a key period in the early history of the secular decline of infant mortality. The time span is rather short, but entering the data from the Vaccination Birth Registers for a sizeable town such as Cambridge is very time consuming. The six years covered were a key period in the early history of the secular decline of infant mortality. In 1905, for the purposes of civil registration, Cambridge was divided into three sub-registration districts. At that time, the majority of the population lived in the St. Andrew the Less sub-district and so, not surprisingly, the great majority of 1905 births were recorded in its Vaccination Birth Register (752 entries). A further 72 births were recorded in the 1905 register of St. Andrew the Great and a further 67 in that of St. Giles. From 1906, following re-organisation of the sub-registration districts, St. Andrew the Great and St. Giles were combined into one sub district, St. Andrew the Great. The sub-registration districts were again re-organised in 1912 when Chesterton, previously the rural hinterland of Cambridge, was incorporated into Cambridge Municipal

Borough. This change was a further reason the detailed period of study was confined to the years 1905-1911. The number of births and infant deaths recorded for the period covered appear in Table 2.1.

Table 2.1: Births and infant deaths recorded in the Vaccination Birth Registers of St. Andrew the Great and St. Andrew the Less, Cambridge 1905-1911

	St. Andrew the Less		St. Andrew the Great	
Year	Births	Deaths	Births	Deaths
1905	752	58	139	12
1906	660	80	131	21
1907	702	62	114	10
1908	672	97	119	15
1909	724	57	130	14
1910	702	57	122	4
1911	656	63	105	8

Source: Cambridge Borough Vaccination Birth Registers 1905-1911

Public Vaccinators, in the period under consideration here, mostly vaccinated children in Cambridge, free of charge, in the child's own home. Persons over the age of ten years were vaccinated, free of charge, by the Public Vaccinator in his surgery or at the person's own home (C.O.S. 1904: 105). Alternatively parents could arrange for a private vaccination. In 1904 the public vaccinators in Cambridge were J. Buckenham, Huntingdon House, Castle Street for the St. Andrew the Great sub district and for the St. Andrew the Less district F. E. Apethorpe Webb, Newmarket Road and C. K. Dutt, Guest Road (Spalding, 1904: xi). The Vaccination Officer recorded the name of the doctor giving the vaccination in the Vaccination

Birth Register. It was the duty of the Vaccination Officer to follow up infants not vaccinated, the remarks column in the Vaccination Birth Register gave details of this follow up and the evidence shows repeated attempts to carry out the vaccination were made before any legal action was instigated. On occasions a code number was recorded in the remarks column, this referred to a code number in the Vaccination Officer's Report Book where more information was given.

The only surviving Vaccination Officer's Report Book in Cambridge covers the period January 1905 to December 1907 when the record stops abruptly. It contains the following: - the entry number, birth registration district, the entry number in the birth register, the name of the child, date of birth, address, date or dates of personal enquiry by the Vaccination Officer. From 1905-07 inclusive there were 78 (out of 2,502 births) entries in the Vaccination Birth Registers for Cambridge, 64 of these were in the 1905 register for St. Andrew the Less. In the case of a certificate of postponement being given the following details were recorded: certificate date, the name of the person issuing the certificate, and the cause for postponement. The reason for postponement of vaccination may have been because the infant was not fit for vaccination at that time or because the parents objected on grounds of conscience (i.e. a firm belief that the process would do the child harm).

The Vaccination Act of 1907 gave parents the right to apply for a Certificate of Exemption from vaccination. Table 2.2 shows that when this Act came into force on the 1st January 1908, the number of exemptions from vaccination on the grounds of conscience rose dramatically in Cambridge. This is probably why recording in the Vaccination Officer's Report Book came to an abrupt halt then, as noted above. It seems likely that there was another report book that has not survived, since the entries in the Vaccination Birth Registers with a code number relating to a report book increased substantially after 1908. The Medical Officer of Health for Cambridge stated that the increased number of exemptions granted on the grounds of conscientious objection was a direct result of the Vaccination Act 1907 (MOH Report, 1909: 16).

Table 2.2: Number of infants exempt from vaccination: Cambridge 1905-11

	1905	1906	1907	1908	1909	1910	1911
Exempt	66	51	96	409	470	472	439
Births	891	791	816	791	854	799	764
% Exempt	7.4	6.4	11.8	51.7	55	59.1	57.5

Source: MOH reports Cambridge Borough Union 1905-1912

The data in the Vaccination Birth Registers confirms the rise in the number of infants exempted from vaccination with the result that fewer 'healthy' individuals were removed from observation in the first year (Table 2.3).

Table 2.3: Numbers of infants vaccinated or exempted from vaccination, Cambridge 1905-12

Year	Vaccinated	Exempted	Total	% exempt
1905	749	39	788	4.9
1906	676	27	703	3.8
1907	565	168	733	22.9
1908	333	338	671	50.4
1909	313	427	740	57.7
1910	263	439	722	60.8
1911	258	400	658	60.8
1912	265	432	697	62.0
1905-12	3442	2270	5712	39.7

Source Vaccination Birth Registers, Cambridge 1905-1913
Reference nos. G/C/x vols. 2-18 inc.

The average age of vaccination in Cambridge over the period 1905-12 was 130 days whilst the average age at which a Certificate of Exemption was issued was 78 days. The timing varied slightly from year to year (see Table 2.4) but the average age for vaccination fell in the fifth month of life whilst the average age when a Certificate of Exemption was issued fell in the third month of life. Since it has been shown that exempted infants remain 'in observation' unless they are subsequently vaccinated or they die then as the number of exemptions increase the number of infants 'in observation' increases.

Table 2.4: Average age in days at which an infant was vaccinated or exempted from vaccination, Cambridge 1905-1912

Year	Vaccinated	Exempted
1905	130	71
1906	132	73
1907	132	80
1908	129	74
1909	126	73
1910	124	78
1911	128	80
1912	130	84
1905-12	130	78

Source: Vaccination Birth Registers Cambridge 1905-1913

Accuracy of content

For the purposes of this thesis it is crucial that the births and deaths recorded in either the Vaccination Birth Register, or the deaths in the Infant Death Register are complete but not all deaths are recorded in the Vaccination Birth Register, only that pre vaccination, so they can only be as 'complete' as this allows . There is no direct way of knowing this, but some indirect evidence suggests that parents were conscientious in registering the birth of their offspring. This is provided by the returns under the Notification of Births Act, which was passed in 1907. Under this Act, a birth was to be notified to the MOH[3], by the attending midwife or doctor, within 36 hours of the event taking place. The purpose was to inform the MOH and health visitors as soon as possible after the event that a birth had occurred, so ensuring that the child's needs could be assessed promptly and, when necessary, remedial action could be taken. The Act was not, however, mandatory and the government told local authorities that if they did not intend to appoint health visitors, they should not adopt it. This was so as not to add another burden on parents when the information they gave served no useful purpose. In Cambridge the first two health visitors were appointed in July 1906 and Cambridge adopted the Act on the 1st July 1909, so the first complete year that the Act was in operation was 1910. The MOH reported that the actual number of infants registered as born in that year was 799 of which 638 (80 per cent) were notified within 48 hours. Of these, midwives notified 472, doctors notified 135 and parents notified 31 (MOH report, 1910). That as many as 80 per cent of children had their birth notified within 48 hours does suggest that most parents in Cambridge acted responsibly. And, after all, the remaining 20 per cent, of births known to the Registrar, were registered eventually. There may have been some births which were not registered and did not appear in

[3] The process of notification was different to that of registration

official statistics until their details were recorded in a subsequent census.

In Cambridge the Infant Death Registers have only survived from 1912 onwards. They were compiled by the Vaccination Officer from copies of the civil registers of deaths, sent to him by the local registrar each week. From these he was able to learn of children who had died before vaccination. By entering the information in his Vaccination Birth Register he was able to avoid chasing up families where an infant had died before it was due to be vaccinated. The contents of the Infant Death Register appear in Figure 2.2.

The deaths of all infants who died before vaccination were recorded in the Vaccination Birth Register and this included those infants who had been granted a Certificate of Exemption from vaccination. Entries in the Infant Death Register for the years 1912 and 1913 were compared with deaths recorded in the Vaccination Birth Register (Table 2.5). Sixty two per cent of the infants whose details were recorded in the 1912 Vaccination Birth Registers were exempted from vaccination, on grounds of conscience (Table 2.3), Therefore it is not surprising to find that all deaths, apart from deaths of infants born outside Cambridge, appeared in the Infant Death Register and were recorded in the Vaccination Birth Register.

Table 2.5: A comparison of the number of infant deaths recorded in the Vaccination Birth Register (VB) with those recorded in the Infant Death Register (ID): Cambridge 1912 and 1913

				Age at death in complete months											
	Births	Deaths	Exempt	0	1	2	3	4	5	6	7	8	9	10	11
1912 VB	677	57	400	20	10	4	6	5	2	3	3	1	1	2	0
1912 ID		56		20	10	4	5	5	1	3	4	1	1	2	0
1913 VB	652	46	582	27	5	2	4	1	2	0	0	2	2	0	1
1913 ID		40		29	1+1*	2	5	1	1	1+1*	0	0	1+ 1*	0	0+ 1*

*** death recorded in 1914 Infant Death Register**
Source: Cambridge Vaccination Birth Registers 1912 and 1913, St. Andrew the Less, Infant Death Registers 1912 and 1913

In 1912 one death recorded in the Vaccination Birth Register was not recorded in the Infant Death Register. The reason for this may have been that the family moved out of the area prior to the death of the infant. In the 1913 Infant Death Register the deaths of six infants born outside Cambridge were registered. [4] Two infants died at age nine months, two at six months and one at ten months of age. The remaining infant, from Leicestershire, died at one month of age. Therefore, it seems that for infants exempt from vaccination any subsequent death was recorded in both the Infant Death Register and the Vaccination Birth Register; as they had not been vaccinated their death had occurred 'prior to vaccination'. This means that as the number of infants exempt from vaccination increased, the Vaccination Birth Registers contained more infant deaths, despite infants dying following vaccination still not being recorded in the document. Table 2.2 showed that for the years 1908, 1909, 1910 and 1911, over 50% of infants were exempted from vaccination. Therefore it must be concluded that in those years the great majority of infant deaths were recorded in the Vaccination Birth Registers.

Strengths and weaknesses

The Vaccination Birth Registers are legible and all the relevant information columns are completed. On a very few occasions the house number was not given when death occurred in the first days of life.

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[4] Infants born outside Cambridge were identified as those for whom no Infant Birth Register number was recorded in the Infant Death Register.

That this information was omitted so rarely indicates again that most parents of children born in Cambridge respected the law in this regard: another pointer to the reliability of the data on which this thesis depends.

Different registrars, however, provided a variable level of detail on parental occupation. For instance in St. Andrew the Less district the type of work done by labourers is not specified whereas in St. Andrew the Great it is.

The registers give information on the legitimacy of the infant registered. In Cambridge evidence from the Vaccination Birth Registers shows that a high percentage of illegitimate infants were born in the workhouse. It appears that the practice in the workhouse was to notify the registrar early and to have the vaccination carried out swiftly, often within the first month of life (Vaccination Birth Registers, Cambridge 1905-1914). The result is that deaths of illegitimate infants are under-represented relative to those of legitimate children in this source. For a more accurate representation of their mortality one is, therefore, dependent on the aggregative information supplied by the Medical Officer of Health Reports (Cambridge MOH reports, 1908-1911). Unlike the Vaccination

Birth Registers and the Infant Death Registers, these do, however, supply cause of death, but not for individual infants.

The main strength of the Vaccination Birth Registers as a source of data is that they do enable one to link the birth of an infant to its death if this occurred prior to vaccination. The Vaccination Birth Registers are only source currently available to the public that does so. A weakness is that there is no record of what happens to the child after vaccination. It may be alive, may have died, or may have moved away. The only certainty is that on the date the Certificate of Successful Vaccination was given, the child was alive. The Vaccination Birth Registers are then a reliable source of information when investigating neonatal infant mortality. In combination with the Infant Death Registers, where they have survived, they are a reliable source for investigating infant mortality throughout the first year of life.

When a *Certificate of Exemption* from vaccination on the grounds of conscience was given, the infant remained in 'observation' for longer than the usual time. The authorities kept the infant on their books until it was vaccinated. In the Vaccination Birth Registers there is evidence that when vaccination took place later in childhood this was also recorded e.g.

in the St. Andrew the Less Vaccination Birth Register for 1912 some children are recorded as being vaccinated in 1919(1), 1920 (2), 1921 (1), 1922 (1), 1923 (1), 1923 (1). This demonstrates that infants with a Certificate of Exemption from vaccination were in observation throughout infancy and beyond. In other words exempted infants not subsequently vaccinated can be assumed to have survived to their first birthday unless their death was recorded. The Cambridge registers give details of infants who moved out of the area and were subsequently vaccinated so it must be concluded that a national system existed for communicating this information. It seems that, at least for Cambridge, the Vaccination Officers followed the instructions implicitly and recorded all deaths occurring prior to vaccination even when the number of exemptions increased dramatically. Only 7.4% of infants born in 1905 were exempt from immunisation whereas 57.5% were exempt in 1911 (Table 2.2). This has important implications for the way in which mortality can be measured, since the number of deaths recorded, as a proportion of those that occurred, changed over time. This matter is dealt with below.

Reports on the Sanitary Condition of the Borough of Cambridge (frequently referred to as the Medical Officer of Health Reports)

The first Medical Officer of Health (MOH) for Cambridge, Bushell Anningson, took up his post in mid 1875 (MOH report, 1875). It seems that he was eminently qualified for the job, as he was not only the University Lecturer in Medical Jurisprudence at Cambridge but was also the University Examiner in State Medicine and a Fellow and Member of the Council and Board of Examiners for the Sanitary Institute of Great Britain (MOH report, 1875). He was also a Fellow and Member of the Council of the Royal Institute of the Public Health (MOH report, 1875). Anningson was in post until 1908 when Andrew John Laird was appointed, a position he held until 1937 (MOH report, 1938). Anningson's reports as MOH follow a similar format for the thirty years he was in office, making it easier to make comparisons. (MOH reports, 1875-1907).

Copies of MOH reports are available on an annual basis. Since Anningson did not come in to post until July 1875 the first report deals with a six month period but subsequent reports cover a complete year. The reports provide an enormous amount of data relating to the health of the population generally and specifically to infant mortality. When a new Medical Officer of Health came into post changes in presentation and content of the Cambridge Reports reflected changes in local conditions, the contemporary national perspective and the interest of the MOH. For example from 1906 onwards there is a section on infant mortality including an analysis of infant mortality rates by legitimacy, and a section on the work of the health visitors. It was in that year that the First National Conference on Infant Mortality was held, so this may have encouraged these additions.

In the 1900 report Anningson stated that in future years the number of deaths under the heading "infantile diarrhoea" would probably change as a result of an authoritative decision by the Royal College of Physicians. This decision was made in order to avoid any confusion by the "adoption of unauthorised synonyms" (MOH report, 1900: 13). Anningson sent out a memorandum on certification of diarrhoea deaths to all registered medical practitioners in Cambridge, following guidelines suggested by the Incorporated Society of Medical Officers of Health. The number of diseases included in the category 'diarrhoeal deaths' was reduced and only included infective enteritis, diarrhoea, enteritis, gastro-enteritis, dyspepsia, colic, ulceration of the intestines and duodenal ulcer (MOH Report, Cambridge, 1911: 51). This change makes comparison before and after 1900 difficult. However as the main focus of this study are the years 1905-11, it does not pose a great problem.

When using the MOH reports care must be taken to identify what the data provided actually measures. For instance figures for the numbers of infant births and deaths differ within the same document because the basis for measurement is different. Thus, those born in the area but whose parents resided outside it may or may not have been included. For instance in 1883 Table 1, column 3 gave the Infant Mortality Rate for Cambridge for the previous ten years. This included deaths of non-residents (MOH report, Cambridge, 1883: 13). On the other hand elsewhere in the reports the rate is calculated with non residents excluded (MOH report, Cambridge, 1904: Appendix Table II). Anningson goes to great lengths to explain how he created his tables, although on one occasion he all but says 'I hope I got it right' (e.g. MOH Report, Cambridge, 1876). Laird didn't 'get it right'. In reporting on feeding methods, the numbers for each method did not add up! (MOH Report, Cambridge Union, 1910). This demonstrates the importance of looking at any statistical data in a critical manner.

Books/Reports on research projects

The health of the population and the factors relating to it attracted ever increasing attention during the first decade of the twentieth century. In this, Cambridge reflected the national picture and that concern led to a number of studies being conducted in the town. For example, in 1901 the Council of the Christian Social Union [5] advised all branches of the Union "to make a detailed investigation of the housing of the poorer classes in each town and if it is generally the case, private enterprise is found to be inadequate to supply the local needs, to promote the provision of more house room by the municipal authorities under Part III of the Housing Act 1890" (Cayley, 1904: 1). Henry Cayley, a member of the Cambridge University Branch of the Union, was asked by fellow members to undertake such an investigation. Cayley's work gives the results of the enquiry, including a description of how it was carried out. The style of writing is appropriate to the period e.g. "This was done in obedience to the resolution passed..." (Cayley, 1904: 1).

[5] In 1889 Henry Scott Holland formed the Christian Social Union (CSU), a Church of England organisation the stated purpose of which was "to investigate areas in which moral truth and Christian principles could bring relief to the social and economic disorder of society" (www.spartacus.schoolnet.co.uk).

Members from the Ladies Branch of the Union worked in collaboration with the University Branch on this investigation and Eglantyne Jebb was one of the team of investigators. Later she was employed by the Charity Organisation Society (COS), to provide a register of Cambridge charities. The outcome of this work was an enquiry into poverty in Cambridge and the publication of *Cambridge: A Brief Study in Social Questions*. To carry out this work she recruited a team of people that included Gwen Darwin, granddaughter of Charles Darwin. In her work, Jebb refers to Cayley's investigation and states that it was published in the "Economic Review, October 1904" and was also available in pamphlet form from Henry Cayley (Jebb, 1906: 84-89).

The results of Cayley's investigation into the state of housing in Cambridge in 1902-03 and Jebb's work on the social conditions existing in the town during the period 1906-1908 are the most widely used of this type of source in the current research.

The strength of Jebb's work, for this thesis, is that it describes the social conditions of the poor in Cambridge at the turn of the century. It identifies the places where they lived, their living conditions and their way of life. Unfortunately it does not identify people in such a way that they could be linked on an individual level to the Vaccination Birth Registers or the Infant Death Registers. Jebb's first report identifies problems and suggests actions to alleviate them. Her second report describes changes brought about by the implementation of her recommendations. The Cambridgeshire Collection at the Cambridge City Library holds four folders containing notes and correspondence relating to Jebb's study. Part of her study was the production of a 'rent map' similar in nature to those produced by Charles Booth in London. Booth classified London streets according to the affluence of the people living there (Booth, 1902). Jebb's rent map indicated the average rent of the houses in Cambridge streets. The correspondence between herself and Gwen Darwin demonstrates the problems involved in the production of statistical data. One of Gwen Darwin's letters to Eglantyne Jebb suggests that the best method for reaching the average rents for the rent map was probably not used.

> *My Dear Eglantyne*
>
> *I return your 'Spalding' with thanks and also the notebook. The map is finished, with the exception of the new district along the Hills and Cherryhinton Roads, and Newnham Croft, which do not come within the Cambridge Borough District. Would you like me to do those parts too? Chesterton, which is much the largest suburb, is done. My feeling about this is that it is hardly worthwhile to make out these suburbs; 'though the Hills*

Road one is really quite large. If you would in <u>the least</u> care for me to do them, I should be glad to do so.

There are also a good many houses along Trumpington Road; but I think we might safely place them all in Class A without looking them up. Of course if the map is printed, I should like all the wiggle-waggledy lines made even. A darker yellow might be better. Also I don't mean it to really have a black frame, such as I've given it.... (I put it round purely for the sensuous delight of the black paint). If you <u>don't</u> want me to do the Hills Road, you could cut off 2 or 3 inches at the bottom of the paper.

Do you want an account of the method I used for finding the averages? I am sure now it wasn't the best way, so perhaps it would be better not to give it...Isn't this a mean low idea.

Yours affectionately

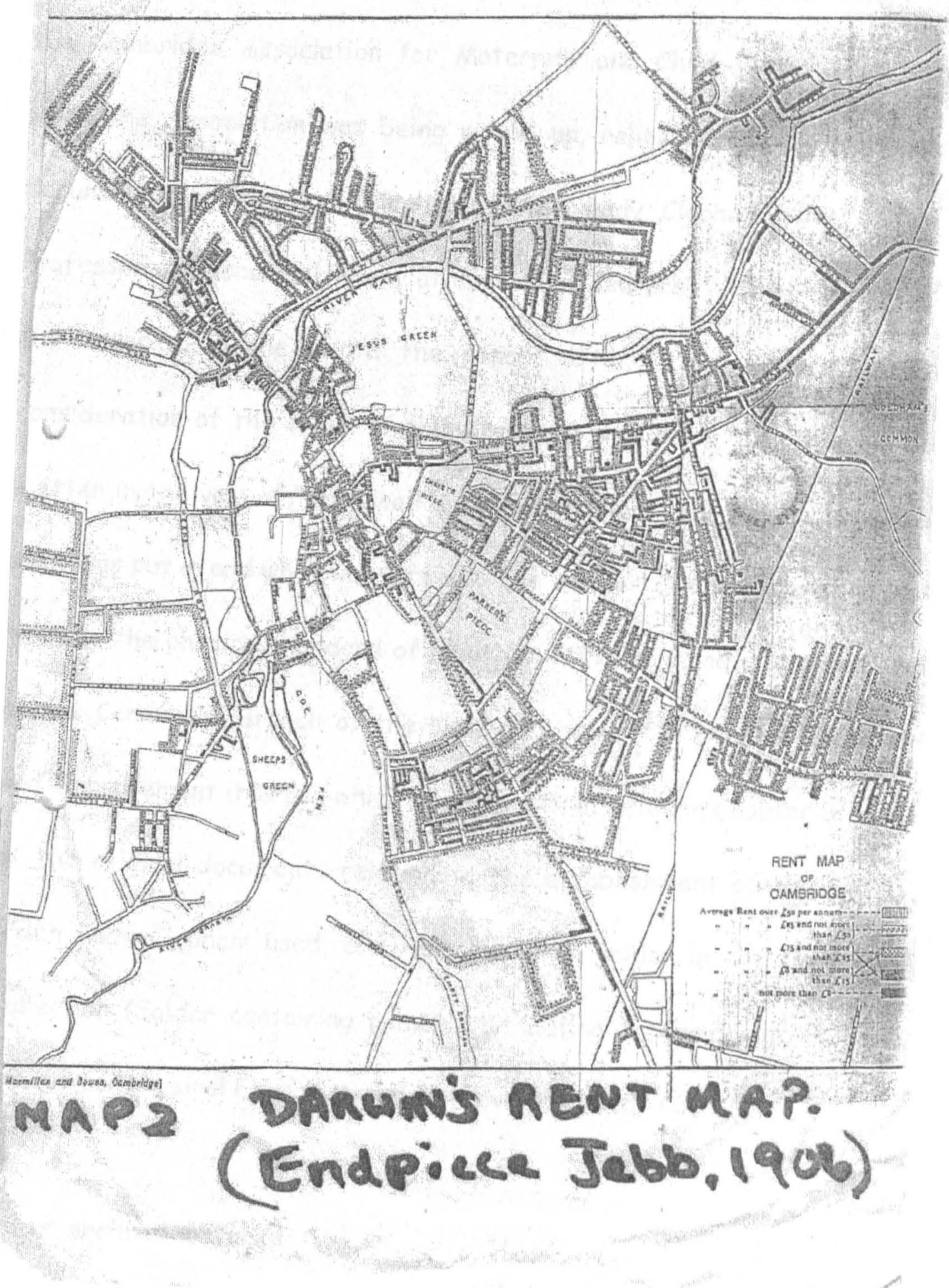
Gwen Darwin

Do you think I ought to do the whole map over again by the better method?

Subsequent letters give no indication of Jebb's reply to this last question. In another letter Darwin admits confusion over two rent groups. The copy of the rent map in Jebb's book shows the correction marked on the map in the lower right hand corner. Arrows indicate that the shading and markings of properties with an average rent of over £15 and not more than £25 per year and those of over £8 and not more than £15 should be reversed (Plate 2.1). Although Darwin, in her letter to Jebb, describes using colour (yellow), when the map was published it was printed in black and white. In this form it is difficult to differentiate between the groups so they have been coloured in, the pink markings indicate the houses with an average rent of over £50 per annum and are largely to the west, orange indicates house with an average rent of between £25 and £50 per annum, brown the houses with a rent of between £15 and £25 per annum, green those houses with a rent of between £8 and £15 per week and purple indicates those houses where an yearly rent of no more than £8.

The houses in Romsey, to the bottom right of the map, generally have a rental of between £8 and £15 but there are some streets with a rental of between £25 and £50, this includes Ross Street and in Chapter 7 it will be shown to be one of the healthiest streets. To the west of this area is St. Paul's district an area of mixed housing, again discussed in Chapter 7. In the centre of this district can be identified the crowded courtyards with a rental of no more than £8 per year. Above and between these two districts is St. Matthews, where crowded areas can also be identified. To the west are the most expensive rentals in St. Andrew the Great district, this district also has a low rent crowded area, St. Giles, north of the river.

Map 2.1: Rent Map of Cambridge. 1906



Source: Jebb, E. (1906), *Cambridge: a brief study in social questions*, Cambridge, Macmillan and Bowes. (End piece)

In contrast to the work of Cayley and Jebb, Lady Clapham's history of the Cambridge Association for Maternity and Child Welfare, written when the Association was being wound up, relies heavily on previously documented information (Clapham, 1948). Lady Clapham, wife of the Professor of Economic History at Cambridge University, was president of the association, she wrote the report after the final meeting. In consideration of the origin of this document it is likely that it would be written in the vein of "work well done" which might well have determined what was put in and what was left out. The purpose of the association was to raise the physical standard of health in Cambridge and it 'started life' as the Cambridge Branch of the National League for Physical Education and Improvement (NLPEI) which is dealt with in detail in Chapter 8. Some of the original documents relating to the establishment of the NLPEI, which Lady Clapham used, are contained in a folder in the Cambridge Collection (Folder containing pamphlets relating to Cambridge National League for Physical Education and Improvement shelf C30)

Other archival material

The Cambridge Collection houses a wide range of other archival material used in this thesis. Documents relating to the development of the sewerage system in Cambridge provide valuable information about the environmental state of the town in the nineteenth century (Ranger, 1849; Bazalgette, 1866; Stephenson, 1870; Mansergh, 1890; Galton, 1892; Julian, 1911; Andrew, 1995; Cooper, 1995). There are maps and a vast postcard collection that provide a picture of Cambridge at various dates. These are also available on The Cambridge Explorer CD Rom (Brown, 2001). Unfortunately, although there are a number of biographies and autobiographies, which describe life in the town in the nineteenth century, none of these describes the life of the working class (Keynes, M. A. 1950; Raverat, 1952; Porter, 1975; Keynes, M. 1984; Fowler, 1996; Ormes, 2000; Spalding, 2001). Copies of academic theses investigating a range issues related to Cambridge are also lodged in the Collection (Stocker, 1979; Edwards, 1987; Craig, 1994).

QUANTITATIVE METHODS

The Measurement of Infant Mortality

The quantitative methods in this thesis are limited to simple descriptive statistics, with one exception: the measurement of infant mortality. In order to measure infant mortality it is necessary to establish the number of infant births and deaths, either in a given year or for a given cohort of infants. In this thesis, data from the MOH Reports and the Registrar

General's Quarterly Statistics are drawn upon to provide the annual data, whilst the Vaccination Birth Registers are used to produce the cohort. The actual number of infant births and deaths may differ according to which infants were included in the calculations. For instance the Cambridge MOH states in his annual report for 1884 that the Registrar General's Reports were not corrected for deaths of non-residents occurring in public institutions within the town, whereas he excludes non-resident deaths (MOH report, 1884: 17). The first full year for which the MOH reported was 1876 and the last year in which the actual number of infant deaths occurring in public institutions was noted in his report was 1899. In this twenty-four year period the number of non-resident infants who died in the town's public institutions was 153, whilst the total number of infant deaths was 3320. Of the 153 deaths 112 occurred in Addenbrookes Hospital and 41 in the Workhouse. There may, of course, have been non-resident infants who died elsewhere in the town. The deaths were not evenly spread over the twenty-four years. However, in the years when the number of non-resident deaths was relatively high, the IMR was inflated substantially. For instance in 1897 there were 14 such deaths at the hospital and 6 in the workhouse. When the IMR for the town was calculated with those deaths included, it was 133: without them it was 112 (MOH reports, 1876-1899). It has already been noted that there was an upward movement in infant mortality in Cambridge during the 1890s. However, in those years, the number of non-resident infant deaths in Cambridge was 92 compared to only 48 in the previous ten years. When non-resident deaths were removed from the calculation of the IMR that for 1881-1890 was 129 whilst for 1891-1900 it was 132. Hence there was only a very slight upward trend in infant mortality during the 1890s: a significant finding.

On occasions the number of births in a given year, as recorded by the Registrar General, differ from those recorded by the MOH. The reason for this is that infants born in November or December may not have been registered until the following year, so they may not have been included in the statistics for their actual year of birth but for those of the subsequent year.[6] Given this, some discrepancy between annual figures may be expected but over the long term they should be the same or at least very similar. This turns out to be case in Cambridge. The number of births recorded by the Medical Officer of Health for Cambridge for the years 1876-1899 is 23,336, whilst that recorded by the Registrar General is 23,530, a difference of 184. This is largely due to 111 extra births recorded by the Registrar General in 1885.

[6] Registration of a Birth is a different process to Notification of a birth.

Discrepancies between data may be due to errors and oversights in recording. An example of this occurred in the years 1882-84, which, in the long run, made little difference to the IMR but does, however, show that it is necessary to question the data source. It seems a little unusual that in each of the years 1882, 1883 and 1884 the number of births recorded by the MOH in his report on Cambridge was exactly the same: 979. It is even more unusual that exactly the same number of births occurred in each of the four sub-districts, in each of the three years. Elsewhere in the 1884 report the number of births in Cambridge was given as 983 which confirms the suspicion of an oversight but nowhere else in the 1883 report does the MOH give the number of births for that year. The table showing Annual Birth and Death rates for the previous 10 years gives the 1883 Infant Mortality Rate, not corrected for deaths of non-residents as 134 and the number of deaths as 132 (MOH report 1883 Appendix Table 1). Given an IMR of 134 and the number of infant deaths, including non-resident deaths, as 132 then the number of births for that year must have been between 982 and 988.

Calculating the IMR: the conventional versus the cohort method

The choice of method used to calculate an infant mortality rate is constrained by the data available.

Conventional Method

IMR = Total number of infant deaths registered in a given year/Total number of births registered in same year x 1000

The conventional method of calculating the infant mortality rate uses the total number of births and the total number of infant deaths being recorded in a given year. This only gives a general picture since the infants dying are not necessarily drawn from those born in that year (see above). For example a three-month-old baby dying in February 1878 does not belong to the 1878 cohort of births but to that of the 1877, since it was born in December 1877. This method of calculation gives an indication of a general trend. Both the Medical Officer of Health for Cambridge and the Registrar General, in their reports, use the conventional method of calculating infant mortality rate as follows.

Cohort method

IMR = Total number of deaths under one year in cohort/Total number of births in cohort x 1000

If the source data tracks an infant from birth through to his/her first birthday, or to death if this occurs before one year of age, then a cohort infant mortality rate can be calculated. The cohort IMR is arrived at by dividing the number of deaths in a given cohort occurring before the infants reach their first birthday by the total number of births in the cohort. This is then expressed as deaths per thousand live births. This measure gives the risk any child in the given cohort has of dying before reaching its first birthday. A difficulty of both methods of calculating the IMR is that of tracking those infants who move out of the area or are otherwise lost from observation. It has already been identified that one of the problems when using Vaccination Birth Register data is that not all infants can be followed through to their first birthday or date of death if this occurred after vaccination. This means that the cohort measure is of limited usefulness when working with data drawn from the Vaccination Birth Register alone.

Life Table or Survival Analysis

The Life Table or Survival analysis is an 'ideal' measure but the infants need to be observed to their first birthday, or to death for the calculation of a full life table. The Vaccination Birth Register does not provide the necessary information to do this instead it 'selectively' removes healthy infants from observation when they have been vaccinated. The limitations of usage of the Vaccination Birth Registers are demonstrated using data from St. Andrew the Less parish for 1905 and 1912. The years have been chosen because 1905 is the first full year when a complete set of Vaccination Birth Registers are available and 1912 has been chosen as this is the first year when an Infant Death Register is available for Cambridge.

Using individual records the IMR can be calculated at given intervals e.g. months. This is equivalent to the IMR/1000, but measured over a month rather than a year. The cumulative mortality or overall mortality up to the end of each month (each month is taken as being 30 days in length) is given in column 10 of Table 2.6. This final value is the life table estimate of the IMR.

Table 2.6 uses the Vaccination Birth Register data to calculate the IMR at monthly intervals; each month is taken as being 30 days in length. Where no date of vaccination or death is recorded those infants are considered to be not in observation after the day of birth and are recorded in column 4 as, 'went out'. Since the last date at which these infants were 'in observation' was on their day of birth then they are recorded as 'went out' in the first month.

Table 2.6: Life Table for St. Andrew the Less, Cambridge 1905

Births 749

	Losses			Gains		Life table mortality		Survivors	Deaths	Cum. Deaths
1	2	3	4	5	6	7 a	7 b	8	9	10
Age in days	Deaths	Vaccinated	Went out	Came in	At risk	nqx	q(x)	l(x)	d(x)	Cum d(x)
<30	16	3	17	0	749	0.0214	0.0214	1000	21	21.4
<60	9	45		0	713	0.0126	0.0340	979	12	33.7
<90	8	73		0	659	0.0121	0.0461	966	12	45.4
<120	5	109		0	578	0.0087	0.0548	955	8	53.7
<150	6	277		0	464	0.0129	0.0677	946	12	65.9
<180	0	46		0	181	0.0000	0.0677	934	0	65.9
<210	1	31		0	135	0.0074	0.0751	934	7	72.9
<240	1	14		0	103	0.0097	0.0848	927	9	81.9
<270	1	13		0	88	0.0114	0.0962	918	10	92.3
<300	3	6		0	74	0.0405	0.1367	908	37	129.1
<330		6		0	65	0.0000	0.1367	871	0	129.1
<365		5		0	59	0.0000	0.1367	871	0	129.1
					54	0.0000	0.1367	871	0	129.1
Total	50	628	17	0						

Aggregate-Based Infant Mortality 66.8

Individual-based Infant Mortality 129.1

Source: Vaccination Birth Registers, Cambridge 1905-06
Reference nos. G/C/x vols. 2, 3 & 4.

In 1905 (Table 2.6) out of 749 births 578 (77%) were still in observation at 3 months. Thirty three (4.4%) had been lost through death, but 121 (16.1%) had been 'lost' through vaccination. Only 3 children were removed from observation through vaccination in the first month showing that the vaccination register data is particularly robust when calculating neonatal mortality.[7]

[7] Neonatal Mortality Rate is the number of deaths of infants aged less than 28 days born to mothers resident in an area, per 1,000 births to mothers resident in that area.

As noted above when constructing these tables it has been assumed that each month = 30 days but conventionally neonatal mortality is taken to consist of deaths in the first 28 days or 4 weeks of life not 'the first calendar month'. When the Vaccination Birth Register data is used to provide individual records 'healthy' children are selectively removed from the pool of children being no longer under observation once they are vaccinated. This can result in an over inflated measure by the year-end.

Table 2.7: Life Table for St. Andrew the Less, Cambridge 1912
Births 678

	Losses			Gains		Life table mortality		Survivors	Deaths	Cum. Deaths
1	2	3	4	5	6	7 a	7 b	8	9	10
Age in days	Deaths	Vaccinated	Went out	Came in	At risk	nqx	Q(x)	l(x)	d(x)	Cum d(x)
<30	17	6	9	0	678	0.0251	0.0251	1000	25	25.1
<60	11	13			646	0.0170	0.0421	975	17	41.7
<90	4	28			622	0.0064	0.0485	958	6	47.8
<120	6	37			590	0.0102	0.0587	952	10	57.8
<150	5	32			547	0.0091	0.0678	942	9	66.1
<180	2	30			480	0.0042	0.0720	934	4	70.0
<210	3	11			448	0.0067	0.0787	930	6	76.3
<240	5	6			434	0.0115	0.0902	924	11	86.9
<270	1	4			423	0.0024	0.0926	913	2	89.1
<300	1	1			418	0.0024	0.0950	911	2	91.2
<330	2	0			416	0.0048	0.0998	909	4	95.6
<365	0	2			414	0.0000	0.0998	904	0	95.6
Total	57	200	9	0	412	0.0000	0.0998	904	0	95.6

Aggregated-based Infant mortality 84.1 Individual-based Infant Mortality 95.6

Source: Vaccination Birth Registers, Cambridge 1912-13.
Reference numbers G/C/x vols. 16, 17 and 18.

Since the earliest surviving Cambridge Infant Death Register that can be used to both test the accuracy of the Vaccination Birth Register data and provide all deaths occurring under one year of age is that for St. Andrew the Less in 1912, then that is the first year we can compare the results of the three infant mortality measures described above.

Conventional Measure: 1000* 51 deaths/ 678 births = 75

Cohort Measure: 1000* 57 deaths/678 births = 84

Life table based estimate = 95.6 (see Table 2.7)

The cohort measure and the life table-based estimate are based on the same cohort individuals. As this is so it would be expected that the two measures would be the same but the measures are based on data collected from the Vaccination Birth Registers and as discussed above infants are not 'in observation' after vaccination. This is taken into account in the life table estimate but not in the cohort measure. The result is that the two measures differ. The conventional IMR is a **period** measure, it measures births within one year and then looks at the number of deaths to children under the age of one occurring in that year. The measure is calculated using these two figures and it assumes that the number born in the previous year but dying in the 'focus' year are roughly equivalent, but in years of epidemic this may not be the case.

The cohort and life table measures are unreliable when using the Vaccination Birth Registers to calculate infant mortality throughout the first year life but are fairly robust for the first three months of life. Therefore the life table estimates will be used to compare and contrast infant mortality over time, space and social group for the first three months of an infant's life.

Table 2.8: *Comparison of three methods of calculating infant mortality from the Vaccination Birth Registers*

	Problem	Recommendation
Conventional Measure	Deaths after vaccination 'missing'	MOH data will be used to identify trends
Cohort Measure	Healthy infants not 'in observation' after vaccination	Not useful as a measure because all infants cannot be followed through to first birthday
Life table mortality Measure	Inflated mortality rate at one year as healthy infants selectively removed at vaccination	Limited usefulness as a measure at 12 months but robust when calculating q(30 days), q(60days) and q(90 days). Useful to investigate neo-natal infant mortality using detailed Vaccination Birth Register data.

Table 2.8 summarises the problems with each method of calculating infant mortality and makes recommendations for the use of these measures in this thesis.

Conclusion

In this thesis, then, the Annual Reports of the Medical Officer of Health and the Registrar General will be used to provide the total number of births and deaths across the time span of 1876-1911. Except where stated the Medical Officer of Health data, with non-resident deaths removed, will be used to calculate the infant mortality rate using the conventional method of calculation. The Vaccination Birth Registers will be used from 1905 onwards, using the life table method to calculate the likelihood of the infant's dying within the first month q(30 days), the first two months, q(60 days) and the first three months q(90 days) of life.[8]

Turning to the qualitative data, this investigation has derived a great deal from the studies of Cayley and Jebb and their associates. As will be shown below, the issues surrounding public health were enthusiastically

[8] The individual neo natal mortality measure will be calculated at q(30 days) rather than q(28days)

debated by some of Cambridge's most public-spirited residents, drawn from the ranks of the University and the Town. This thesis has also drawn a great deal on the long run of Medical Officer of Health Reports available for Cambridge, from, the first in 1875 and throughout the period of this study.

In sum, although, as always, one would have wished for more and richer sources, what there are have proved adequate for the task.

Chapter 3: Nineteenth and early twentieth century Cambridge

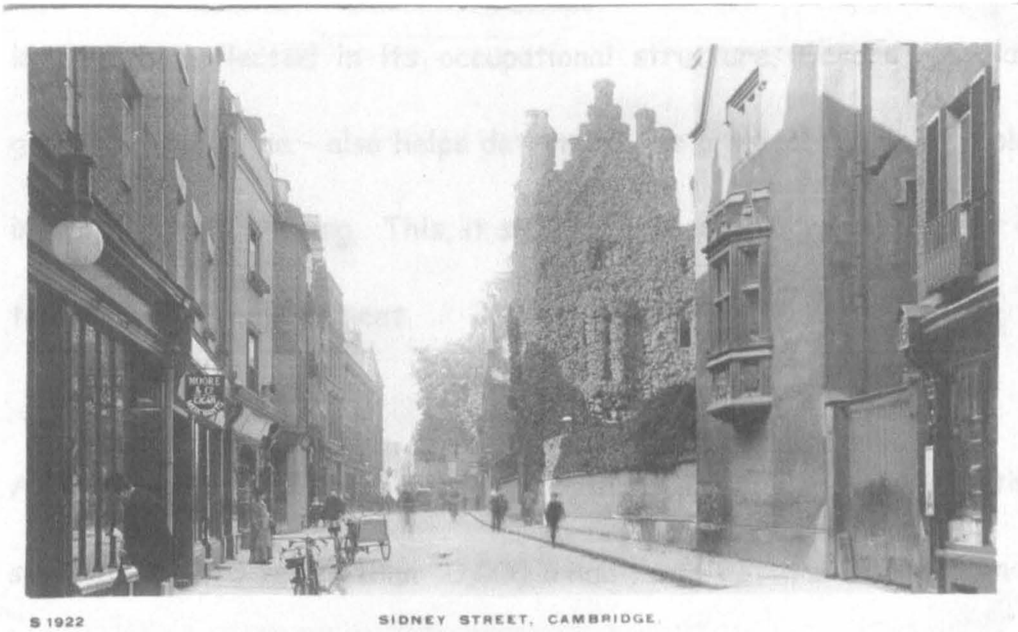


Figure 1: Postcard circa early twentieth century showing Sidney Street, Cambridge. On the right of the picture are some of the buildings of Sidney Sussex College and on the left the shops with Moore and Co. Cigar Manufacturers in the foreground.

Introduction

In this chapter I aim to provide a suitable context for the study as a whole. To that end I look in some detail at those elements of the Cambridge environment, which have a direct bearing on one of the two propositions I seek to explore in this thesis, namely the impact of the built environment and occupational structure on infant mortality. This requires an understanding of the growth of Cambridge's population, the cause of that growth and in what parts of the town it occurred and at what rate. There are two reasons for this: first, population growth - or decline - largely reflects the economic circumstances of a place, and this in turn is reflected in its occupational structure. Second, population growth - or decline - also helps determine the physical fabric of a place, in particular its housing. This, it shall be argued, is a major element of a town's physical environment.

At the beginning of the nineteenth century, Cambridge was a relatively small town, with fewer than 10,000 inhabitants. It was situated on the border of the Fens. At that time the River Cam flowed mostly to the west of the town. A small part of the district to the east rested on chalk, whilst the remainder was on gault (clay), capped in the lower parts of the town by gravel and alluvium (MOH report 1902: 20-21). The population for the most part was still confined to the medieval core of the town, which was dominated in a physical and social sense by the University. Figure 1 demonstrates this, with Sidney Sussex College rising over the street that bears its name.

It has been argued that the University also drove the economy of the town (Rackham 1912 in Bosanquet: 24). However Cambridge was also the market centre for a substantial agricultural hinterland: a feature emphasised by the open fields which surrounded the town up to 1807. The town was also a trading port on the River Cam, until the railway took most of this trade away and developed new ones.

This leads into a discussion of the different parishes in which the town was divided and the registration district of which the parishes were a part. This is important because so much of the aggregative demographic data is presented parish by parish in one of our major sources, the work of Cayley (Cayley, 1904) and by registration district in the MOH reports and the Vaccination Birth Registers. Finally the account then moves from the environmental to the social. What were social conditions like in Cambridge, what were the principal social networks and how did these affect the running of the town?

Population Growth

It is clear from Table 3.1 that the population of Cambridge increased by just under 400% between 1801 and 1911. A remarkable feature of that growth, however, is its variability. Thus in the 1820s the town's population grew by 47.9 %, whilst in the 1850s it actually fell by 5.2%.

Table 3.1. Population of Cambridge 1801-1911

Year	Population inclusive of University	Decadal increase (%)	Population of University
1801	10,087	-	811
1811	11,138	10.4	814
1821	14,142	27.0	Included in parish count
1831	20,917	47.9	Included in parish count
1841	24,453	16.9	660
1851	27,815	13.7	1212
1861	26,361	-5.2	709
1871	30,078	14.1	383
1881	35,363	17.6	846
1891	36,983	4.6	282
1901	38,379	3.8	
1911	40,027	4.3	

Source: Census Report 1911:138

The 1861 Census attributes the apparent decrease of population in the parishes of St. Edward, St. Michael and All Saints to the Census having been taken during the Easter vacation. More importantly, so far as this study is concerned, Table 3.1 shows that Cambridge grew at a very low rate (around 4-5% per decade) in the late nineteenth and early twentieth centuries. Such a slow rate of growth suggests a stagnant economy, which could well have had adverse consequences for the inhabitants of the town, especially its working and lower middle classes (shopkeepers etc). Dr. Dalton investigated the effect of migration on the population of Cambridge and found that the largest group moving out of Cambridge was the 25-35 year age group. He concluded that Cambridge "behaves like a rural district rather than a town. From here young people go forth to earn their living at a distance and go in considerable numbers. At the same time the period of leaving home appears to be later than the usual period in other places" (Dalton 1908:10). This supports the notion that the economy of Cambridge was, at this time, stagnant. Dalton used the Census data for his investigation and argued that out-migration of the 25-35 age group could not be down to the University. The Census was taken during the Easter vacation "and the undergraduates who came up to stay, and are ultimately reckoned in the Census would tend to diminish rather than increase figures" (Dalton, 1908:10).

Prior to the Enclosure Award of 1807 there was very little building outside the medieval core of the town, Population growth in the first half of the nineteenth century was also skewed when it came to its distribution within the town, since such an enormous amount of it took place in just one parish, namely St. Andrew the Less (Table 3.2). St. Andrew the Less was largely to the east of the built-up area on land released for building by the Enclosure Award. The 1851 census states that "The great increase of population in St. Andrew the Less in 1841 is ascribed to the erection of several public buildings, the enlargement of the Colleges, and the consequent employment of mechanics, labourers etc. Several streets of small houses have also been built" (Census, 1851). The Railway came to Cambridge in 1845 and the carrying trade moved from the River Cam to the Railway. Many families in the parish of St. Clement (68) moved as the carrying trade of the Cam declined. The growth of the suburb of Chesterton led to many families moving from the parish of St. Giles (23) (Census, 1851).

In the next decade, the 1850's, the increase in the population of St. Andrew the Less continued and it was attributed to newly built housing (Census 1861). However, an overall decrease of 5.2% in the population of Cambridge in the 1850s (see Table 3.1) was accounted for, in part, by the destruction of houses by fire in the parish of St. Mary the Great (population decrease 31 persons), and the demolition of old and unsafe tenements in the parish of Holy Sepulchre (37) (Census, 1851).

Table 3.2. Population of Cambridge Parishes in 1801 and 1851

Parish	1801	1851	% increase
St. Andrew the Less	252	11776	4573%
St. Benedict	650	1047	61%
St. Mary the Less	555	772	39%
St. Botolph	645	680	5%
St. Edward	665	633	-5%
St. Mary the Great	761	982	29%
St. Michael	310	458	48%
St. Andrew the Great	1082	2281	111%
Holy Trinity	1214	2189	80%
All Saints	704	1503	113%
Holy Sepulchre	479	601	25%
St. Clement	651	971	49%
St. Giles	916	2064	125%
St. Peter	392	646	65%
TOTAL	9276	26603	187%

Source: *Census Report Cambridgeshire parishes (Div 111 South Midland Counties) Cambridge 1851*: 60-61

The growth rate of Cambridge's population declined substantially in the second half of the nineteenth century. And by the end of the century, growth had virtually come to a halt, especially in the 1890s and 1900s. By this time, Cambridge was losing a high proportion of its natural increase (the difference between the births and deaths in the town) through out migration. Thus in the 1890s, according to the 1901 census report, there were 3,060 more births than deaths in the town and yet its population grew by only 1,396. Net out-migration amounted to 1,664 persons, more than half the natural increase.

Table 3.3: Population growth at ward level between 1901 and 1911

Ward	Parishes (see table 3.2)	1901	1911	% Increase or decrease in population
Abbey	All Saints St. Andrew the Less	4484	4909	9.5%
Bridge	St. Michael St. Clement Holy Sepulchre	2744	2513	-8.4%
Castle	St. Peter St. Giles	3022	3183	5.3%
Fitzwilliam	St. Botolph St. Mary the Less	2230	2154	5.3%
Market	St. Mary the Great St. Benedict St. Edward Holy Trinity	1900	1499	-21%
New Town		3989	3843	3.7%
Petersfield		6595	6634	0.6%
Romsey		5352	7238	35.2%
St. Andrew		2498	2322	-7.0%
St. Matthew		5565	5732	3.0%
Total		38379	40027	4.3%

Source: Census Reports Cambridgeshire parishes (Div 111 South Midland Counties) Cambridge 1901 and 1911: 11 Table 9

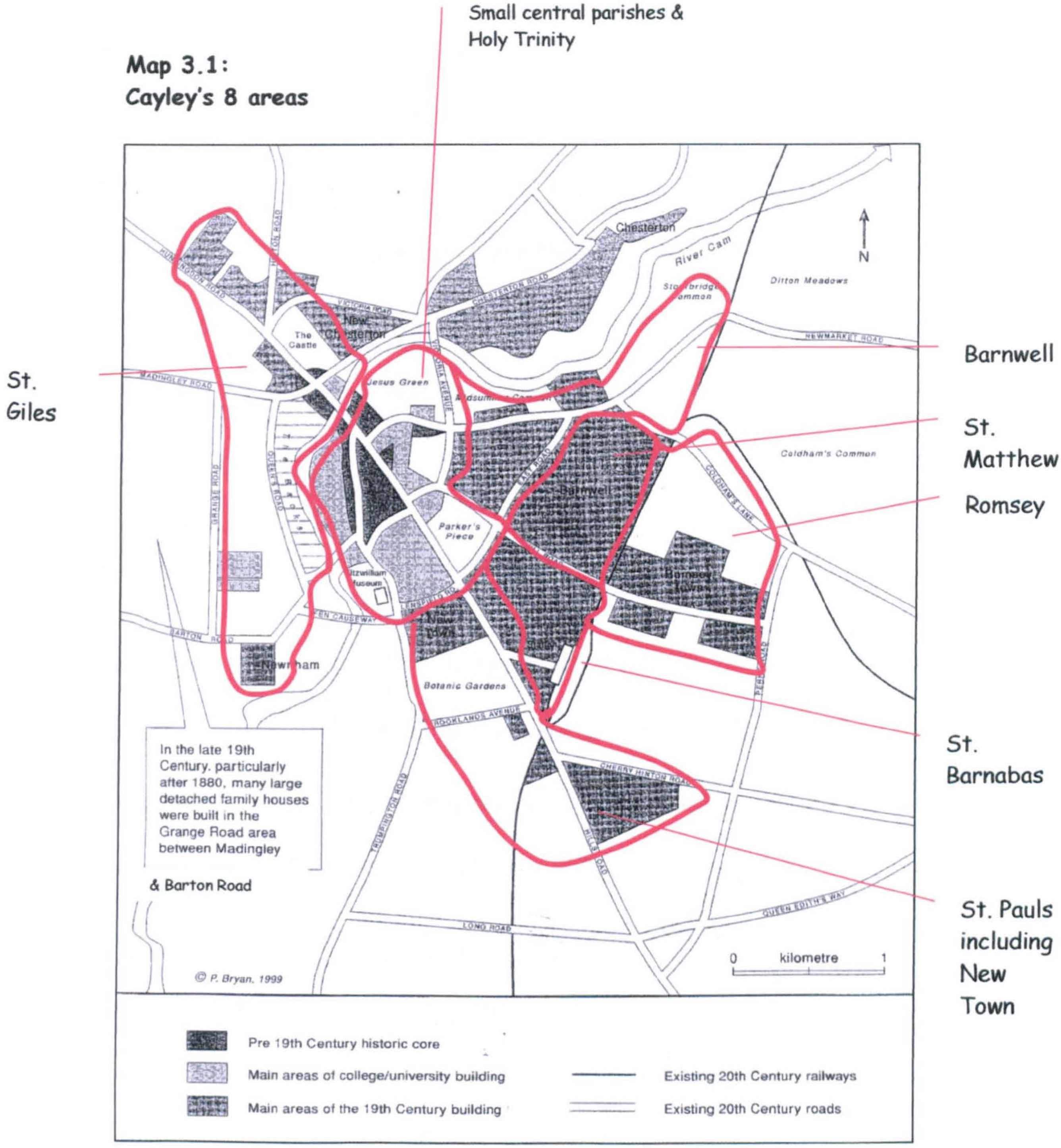
Between 1901 and 1911 Cambridge saw an overall population gain of only 4.3% (Table 3.3) the picture at ward level varied. From 35.2% increase in Romsey to a 21% decrease in Market ward which included the parishes of St. Mary the Great, St. Benedict, St. Edward and Holy Trinity. The 1911 census refers to 'wards' whereas the 1901 census refers to parishes. In Table 3.3 the 1901 parishes used in Table 3.2 are listed alongside the

1911 wards for comparative purposes. It can be seen where growth occurred beyond the medieval boundary of the town. In 1851 there were no equivalent parishes to New Town, Petersfield, Romsey or St. Matthew, by 1911 the parishes, which covered these areas, were all new. Market ward lost 21% of its population between 1901 and 1911, whilst Romsey ward saw an increase in population of 35.2%. The population of the Abbey ward increased by 9.5% whilst Bridge and St. Andrew the Great saw a population decrease of 8.4% and 7% respectively. Although the population of Castle and Fitzwilliam grew it was by only 5.3%. Petersfield remained much the same with only 0.6% population growth (Table 3.3).

What can account for the slowing down in the growth of the population? As the University continued to grow, it cannot be held responsible. Whilst the major loss was in the old medieval town centre of Cambridge the major growth area was in Romsey Town, reflecting the growing importance of the railway. This was in marked contrast to the situation in the first half of the century.

Small central parishes & Holy Trinity

Map 3.1:
Cayley's 8 areas



Source: Bryan (2002) with outline of Cayley's areas

As noted above the major population growth of the first half of the nineteenth century took place in just one parish, St. Andrew the Less (Table 3.2). What of growth in other areas after that date? The next section examines this question. Note that the account is presented using the 8 areas into which Cayley (1904) allocated the parishes of the town, and for which he supplied his findings. Map 1 outlines the area the parishes covered.

1. Barnwell (St. Andrew the Less parish)

To prevent confusion with the *registration district* of St. Andrew the Less, the *parish* of St. Andrew the Less will be referred to as Barnwell, which was the name of the original hamlet in this area. The population of Barnwell grew from 252 in 1801 to 27,962 in 1901 (Jebb, 1904: 10). Cayley describes Barnwell as a large district fairly typical of the poorer parts of Cambridge. The main thoroughfare of Newmarket Road bisects the parish and is "chiefly conspicuous by the excessive number of public houses along it" (Cayley, 1904: 18). The other streets varied in character, from being comparatively newly constructed and "unobjectionable" to older properties in narrow courts with houses with no through ventilation (Cayley, 1904: 18).

2. St. Matthew

The parish of St. Matthew, also known as Sturton Town, lies to the east of East Road, and south of Barnwell. It is a discrete area bounded by East Road to the west, Mill Road to the south, the railway line to the east and Newmarket Road to the north. It was "more uniform in character and generally better laid out" than Barnwell (Cayley, 1904: 18). Cayley reported that structurally the houses were in a fair condition, and although there was some overcrowding the percentages were not high - 85 (3.5%) people living more than two to a room, 425 (17.6%) people sleeping over three to a bedroom.

3. St. Barnabas

As Cambridge grew the parish of St. Barnabas was created in 1888 and extended from the junction of Parker's Piece with Parkside, Mill Road, East Road and Gonville Place in the north. The southern extremity was the railway line. In his farewell letter to the parish in 1907 the Rev. J.W. Thomas (1892-1907) wrote, "Thirty years ago there was neither church nor chapel, nor many dwellings for men to be seen in this part of Cambridge. The cattle grazed in the meadowland, and golden cornfields spread themselves annually over our parochial acres" (in Pemberton, 1980: 15). This area commanded the highest working class rents in Cambridge.

In 1904 the smallest and cheapest property was a four-roomed house with a rent of three shillings and sixpence (Cayley, 1904: 18-19).

4. Romsey Town (St. Philip)

Romsey Town grew rapidly when the railway came to Cambridge in 1845 although the first new houses beyond the railway line were not built until 1879. The rapid growth in housing south of the railway line in Romsey Town saw the establishment of the parish of St. Philip there in 1890 (Pemberton, 1980: 9). Previously the area had been in the parish of St. Matthew. The district developed rapidly and the *Cambridge Chronicle* in 1895 stated, "The district has about 300 houses containing 1500 people. There were no surface drains, in wet weather small lakes formed almost up to the knees. It has no sewer, the cross streets are all private ones, and have no footpaths or carriageways. Residents there are in deplorable state, some have no water supply" (*Cambridge Chronicle*, 7th March 1895). These conditions must have improved by the time Cayley carried out his housing survey because he reported that more water taps were provided than in most areas. Overcrowding was reported to be low and each property had its own yard and water closet, but not all had a flushing cistern. The main problem was that over a quarter of the houses had no flushing arrangement to the water closet (Cayley, 1904: 1). This problem was rectified by 1908 when Jebb published her second edition of *Cambridge: a brief study in social questions.* Where she makes it clear that flushing systems were inserted in this houses, 330 cisterns being supplied in 1907 (Jebb, 1908: 272r). It is interesting to note that the rateable value of labourers' homes in Romsey was higher than of those in St. Matthew.

5.St. Paul including New Town

The parish of St. Paul extends on both sides of Hills Road. The area to the west of Hills Road is known as New Town where Cayley reported an amount of overcrowding in excess of the average for Cambridge, and a greater than average deficiency of water supply and sanitary arrangements (Cayley, 1904: 19). Rex Salisbury Woods, later a GP in Cambridge, made his first visit to the town in 1910 when he tried for a scholarship at Caius College. He describes a house in the New Town area as being in the ugly end of town. "The front door opened directly on the pavement where yelling children sat or played games; and the sitting room was cheerless and dingy with all the Victorian horrors of antimacassars, lace covered mantelpiece, wax fruit, stuffed birds, the inevitable aspidistra in a ribbed pot on the window" (Woods, 1962: 26).

6. Holy Trinity

"This parish is a small one, but has features of its own, which rendered it undesirable to group it with the central parishes" (Cayley, 1904: 29). The population was only 232 but there was a high percentage of overcrowding in King Street and adjoining courts, these were situated between Barnwell (St. Andrew the Less) and the centre of town. The state of the houses left much to be desired being defective in height, with only small yards and groups of houses sharing one tap.

7. The small central parishes of St. Andrew the Great, St. Clement, St. Mary the Less, St. Mary the Great, St. Sepulchre, All Saints, St. Benedict, St. Botolph, St. Edward and St. Michael.

The small central parishes can be divided into two groups, those where there were properties with a rent of less than 6/- per week and those without. The total population of the five parishes where low rent properties were located was 3901 and the parishes included were those of St. Andrew the Great (population 1550), St. Clement (826), St. Mary the Less (905), St. Mary the Great (338) and St. Sepulchre (282). The remaining five parishes, where no houses came within the scope of Cayley's enquiry, had a total population of 2360, the parishes being All

Saints (749), St. Benedict (811), St. Botolph (370), St. Edward (273) and St. Michael (157).

The total number of people living in the small central parishes (6261) was similar to that of the parishes of St. Andrew the Less (8028), St. Matthew (6278) and St. Barnabas with St. Philip (8912). The proportion of houses with a rent of under six shillings per week rent was less in the smaller central parishes than in the other parishes, the exception being the parishes of St. Barnabas and Holy Trinity. Cayley found this district harder to describe, as the condition of housing was so variable. In the case of overcrowding, rather than a large proportion of less serious overcrowding there were a few cases of serious overcrowding. Business premises were extending and as a consequence the small houses with unsatisfactory conditions were being demolished (Cayley, 1904: 20)

8. St. Giles

St. Giles was a parish of contrasts, containing as it did the poor working class area north of the River Cam known as Castle End and the larger houses at the "backs" of the colleges. All the houses in Cayley's inquiry were in Castle End, one of the oldest parts of the town with houses laid out in a very irregular manner and with numerous narrow passages (Cayley, 1904). The following recollection by Charles Bell gives an impression of the area. Bell lived all his life here and was heavily involved in church activity as the churchwarden:

> "I was born at 34 Gloucester Street, a rather squalid street opening from Castle Street with no outlet but leading directly to my father's timber yard and business premises. Our house was a low little house made of two cottages knocked into one as I remember it. But previously when my father first moved there was only one cottage, the larger one containing two rooms below and three bedrooms above and two attics and a kitchen or rather a cellar in the basement. A large garden stretched out at the rear" (Bell, 1889 in St. Giles, 1975).

Housing in Cambridge at the beginning of the twentieth century

As noted above, the rate of growth of Cambridge's population fell substantially in the late nineteenth century. This, on the face of it, should have led to less overcrowding. That it did so is apparent from two sets of statistics. The first shows that the number of houses in Cambridge rose quite sharply in the 1890s, from 7,893 in 1891 to 8,700 in 1901, or by 10.2% (Census report 1901). This, it should be remembered was when the population of the town rose by only 3.8% (Table 3.1). The second set of statistics relates to the average number of occupants per room in tenements with less than 5 rooms, i.e. the smaller houses and, therefore, the ones most prone to overcrowding.

Table 3.4: Average number of occupants per room in tenements of less than 5 rooms, Cambridge 1891

Tenements		Population in tenements	Average number of people per room
Rooms	Number		
1	79	122	1.54
2	402	853	1.06
3	349	1104	1.05
4	1209	4855	1
Total	2039	6934	

Source: Census Report Cambridgeshire parishes (Div 111 South Midland Counties) Cambridge 1891

Table 3.5: Average number of occupants in tenements of less than 5 rooms, Cambridge 1901

Tenements		Population in tenements	Average number of people per room
Rooms	Number		
1	31	53	1.71
2	309	593	0.96
3	289	870	1
4	1109	4083	0.92
Total	1738	5599	

Source: Census Report Cambridgeshire parishes (Div 111 South Midland Counties) Cambridge 1901: 7 Table 20

A glance at Tables 3. 4 and 3.5 shows that in the course of the 1890s, the number of smaller tenements fell (by 19%). They also fell as a percentage of the total housing stock (from 26% in 1891 to 20.0% in 1901) (Census reports 1891 and 1901). In addition Tables 3.4 and 3.5 show that the occupancy of these smaller tenements also fell.

The proportion of tenements with less than five rooms, and the number of occupants within them are not the only appropriate measures of housing conditions. For that we need to look more closely at the fabric of the houses, access to running water and sanitary arrangements. Cayley's investigation was confined to houses with rents of less than six shillings a week situated in the municipal borough of Cambridge. He compared his findings with a similar investigation carried out at this time in Oxford, by the Oxford Branch of the Christian Social Union, and found that the results were very similar. Almost half of the people living in low rent housing lived in situations of overcrowding in both towns. The Registrar General's definition of overcrowding, more than two persons per room, was used in both surveys. Cayley, whilst not measuring the actual size of the room was concerned with purpose for which the room was used and this was related to size. He "counted as a 'room' any room which was likely to be used for spending any considerable part of the twenty four hours in, generally either a kitchen, parlour, or bedroom" (Jebb, 1904: 85). Rooms suitable only for storage such as sculleries, wash-houses, and basement rooms were excluded. In Cambridge 15% of houses, with a rent of less than six shillings per week, were in a state of defective repair. The equivalent figure in Oxford was 16%. One measure of satisfactory housing was the number of rooms reaching a standard height of eight feet. In Cambridge 13% of low rent houses did not reach this standard and in Oxford 9% were defective in this respect. In Cambridge 36.2% of low rent houses shared taps with other households, in Oxford the figure was 22.3% and in York 17.6%. Cayley also compared his findings with those of Rowntree in York. Cambridge fared better in the number of households sharing a water closet; only 4.4% as compared to 13.9% in Oxford and 15.4% in York (Cayley, 1902: 11-14). He also compared the range of rents in the three towns and found that whilst Oxford and York were very similar to each other in this respect, rents in Cambridge were lower especially as the house size increased (Cayley, 1902: 18).

Cayley's investigation into the condition of housing in the working class districts of Cambridge was carried out in 1902-03. He and his team of investigators made personal visits to residents who were asked a number of questions related to the size and condition of the house. They found that although overcrowding had decreased in the previous decade (see above) this was still a problem in some areas, particularly in the central parishes and parts of the town north of the river. They also concluded that although private building continued in the immediate vicinity of Cambridge, transport was lacking to the areas where the cheaper housing was being built. They felt that private housing would fill the demand for low rent housing and therefore pressure for the municipal authority to act under Part 3 of the Housing Act was not necessary. They decided, therefore, that their energies would be best put into pressurising landlords and the corporation to deal with identified deficiencies in the housing. Very shrewdly Cayley and his team noted that if the municipal authority was pressured to provide low cost housing private building would not increase. Without pressure, the remedies recommended by Cayley and his team were more likely to be carried out, with the result that overcrowding would be reduced. The details of the findings of this investigation are drawn upon in Chapter 7 when they are analysed alongside infant mortality in the various areas investigated.

From this account of population change and housing conditions in Cambridge at the end of the nineteenth century, it would appear that whilst, on the one hand, the relatively low rate of population growth and the rise in the housing stock would be likely to ease overcrowding, the fact that there was net out-migration would suggest a sluggish economy with a possibly detrimental impact on standards of living. When compared to comparable towns (Oxford and York), Cambridge is remarkably similar, but Cambridge residents were more likely to share a tap and less likely to share a WC than those in Oxford or York (Cayley 1904: 11-15, 17). Now we turn to the impact of population change, in Cambridge, on the occupational and social structure of the town.

Population change, occupational change and social structure

As a member of the Women's Branch of the Christian Social Union Eglantyne Jebb had worked with Cayley, carrying out some of the personal visits to members of the working class. This must have given her an insight into the living conditions of the poor, which was likely to have influenced her comments in the first two chapters of her study of social conditions in Cambridge, which she published in 1906. Her investigation started with a comparison of early twentieth century Cambridge with the Cambridge of seventy years earlier. She felt that the rapid growth of the town had resulted in what she refers to as a 'New Town' where the poor lived in 'wretchedly miserable conditions'.

She investigated the rates of pay and numbers of people working in the various trades and occupations of Cambridge.[1] She challenged the impression held at that time that there were no factories in Cambridge as she found over one hundred premises subject to factory inspection and fifty per cent of the adult male population employed in producing goods of one sort or another. But she did find that many people in the building trade, particularly carpenters, were unemployed as a result of the extensive introduction of machinery in this trade (Jebb, 1904: 62). Skilled work was available in trades not connected to the building trade but those available to work were unskilled. Jebb reports that in her investigation the almost universal response to the question of supply and demand of the workforces was, "There is any amount of unskilled labour but we cannot find the skilled and reliable men we require" (Jebb, 1906: 63). So it seems likely that the young men 25-35 years of age reported by Dalton to be leaving in considerable numbers to seek work at some distance from Cambridge would have been predominately unskilled (Dalton, 1908: 10).

Jebb used the findings from Cayley's housing survey to make recommendations to improve the state of health of the population. Like

[1] A folder of her letters to the business people of Cambridge and their responses is held in the City Library.

many of her contemporaries she felt that the education of the poor would improve their chances of rearing healthy infants. Cambridge in the late nineteenth century held the record for the highest number of public houses in one street: Newmarket Road had 22 public houses, in the distance of half a mile. So it is not surprising that Jebb mentions the problem of drink, a problem she felt that this was hidden because of the low number of convictions for drunkenness (Rackham in Bosanquet. 1912: 27)

There is evidence that during her investigation she had the opportunity to compare the difference between the lives of the daughters of the poor with those of the wealthy. She acknowledged the lack of understanding the wealthy had of what life was like for the poor. "It is probably no exaggeration to say that both in town and country the majority of women and girls in the wealthier and better educated classes live in what seems a fool's paradise to one who has passed outside the barriers which usually confine them" (Jebb, 1906: 171-2).

Raverat confirms Jebb's conclusion in *Period Piece: a Cambridge Childhood* (1952)[2]. In a chapter on propriety and appearances in the late 19th century she comments on the frequent exhortation of her elders to "not set a bad example to the lower classes". She writes, " I don't believe that the middle classes of those days ever had the faintest idea of the real outlook of the poor. It was true enough that there were two nations in England then" (Raverat, 1952: 102).

Jebb's reference to a hundred premises subject to factory inspection reminds us that the growth of Cambridge was dependent on far more than the University. The railway finally came to Cambridge in 1845 (somewhat later than in some other towns of comparable size because of opposition from the University). [3] It brought new jobs to the town. It has been argued that in the Cambridge context these new jobs led to a new kind of urban working class not exclusively dependent on the University (Edwards, 1977: 11). The railway may have killed off the river trade but it stimulated new sources of employment, such as brick and tile works, cement works, flour milling, sausage making and brewing (Murphy, 1977:

[2] Gwen Raverat née Darwin was the first born child of Maud du Puy and George Darwin, second son of Charles Darwin. Caroline Jebb was Gwen's great aunt and it was to Aunt Cara and Uncle Dick's (Sir Richard Jebb) home that Eglantyne Jebb came when moving to Cambridge

[3] The University resisted the building of a railway station in Cambridge because it was thought that prostitutes from elsewhere would use it to target the relatively large population of male undergraduates.

83). According to the 1901 census the major employment sector for men in the early twentieth century was the building trade, with 2133 (15.6%) of the 13,627 males in work were employed in trades linked to building. This did not include brick makers; six brick making firms were located in the Newmarket Road area. Nor did it include the various cement works in the Romsey Town area; Jebb estimated that those employed in this regular non-seasonal trade included around 500 men mostly in an unskilled capacity (Jebb, 1906: 40).

The number of occupations in the service sector grew, including building, printing, the retail trade and personal service. The University provided much of the latter: Jebb computed that 800 men (5.9%) were engaged in the service of the colleges. A considerable number of women also found employment there: 450 as bed makers and 620 running licensed University lodging houses according to Jebb. The laundries also employed around 600 women. Jebb found that the number of working women in Cambridge was not that different from, say, Gloucester, a town chosen by Jebb as having a similar residential population where 28% of women were in employment (Jebb 1906).

Conclusion

What are the implications for infant health that can be drawn from this brief introduction to the changing occupational and built environment of nineteenth and early twentieth century Cambridge? As a result of the 1807 Enclosure Award land was released for building and this changed the face of Cambridge. Jebb commented that the residents' way of life was affected by the rapid growth in housing to accommodate the increasing population. She contrasted the way of life lived for hundreds of years by residents of, what was then a small agricultural town, with that of the population of early twentieth century Cambridge. "The unpolluted air, pure water and wholesome surroundings of country life" did not exist when people were "massed together in a narrow space" (Jebb, 1906:14)

As Cambridge grew overcrowding led to lack of access to fresh air and pure water which had implications for infant health, particularly in areas of highest growth. In Chapter 5 the transmission route of diseases will be discussed in relation to infant mortality and both fresh air and pure water are important to maintain the health of infants. Cases of overcrowding are conducive to the spread of infectious diseases and water infected with bacteria can lead to the spread of diarrhoea.

The population growth experienced during the nineteenth century was neither evenly distributed over time or space. The first area of rapid expansion into the rural hinterland was to the east of the medieval centre and as the town expanded it reached the hamlet of Barnwell in the parish of St. Andrew the Less. Many houses were built to accommodate the building workers and their families. Indeed the expansion of that parish, from 2252 in 1801 to 11776 in 1851, by which time it accounted for 44% of the town's population, probably exceeded even the most rapid growth of any industrial town in the north or midlands. At the time of Cayley this area was described as typical of the poorest parts of Cambridge (Cayley 1904: 18). It has been shown, in Chapter 2 that the sub-registration district of St. Andrew the Less was not as healthy as that of St. Andrew the Great.

Expansion in other parts of the town reflected different developments e.g. the arrival of the railway in 1845 and the decision, in 1882, to allow College Fellows to marry and still retain their Fellowships. The latter led to a spate of building to the west of the town to accommodate them and their families. This building led to Cambridge having a variety of urban landscapes dependent upon when the building occurred, the circumstances that prompted it.

The economy of Cambridge flourished during the early part of the century but from the 1860s onwards, the rate of growth of the population of Cambridge fell decade by decade. By the 1890s, Cambridge was losing half its natural increase through out-migration. This was an indication that the expansion of the University and the considerable new building that took place, as result was not sufficient to keep the growth rate of the town's population above an almost derisory level. Although new building continued, the urban landscape of Cambridge had been set by mid-century, with the exception of houses built to the west of the town from the 1880s onwards (see above).

Cayley found that despite the slow growth rate overcrowding did exist both in the newly expanded areas of Cambridge and the crowded older parts, such as Castle End, in the parish of St. Giles. At the beginning of the nineteenth century, the University residents accounted for 7.7% of the population, by its end, 9.9%. This relative stability suggests a relatively unchanging impact on the social structure of the town.

Bosanquet claimed that the lack of unskilled employment for men led to a large number of young married women obliged to find paid work thereby resulting in them neglecting their homes and children (Bosanquet: 26).

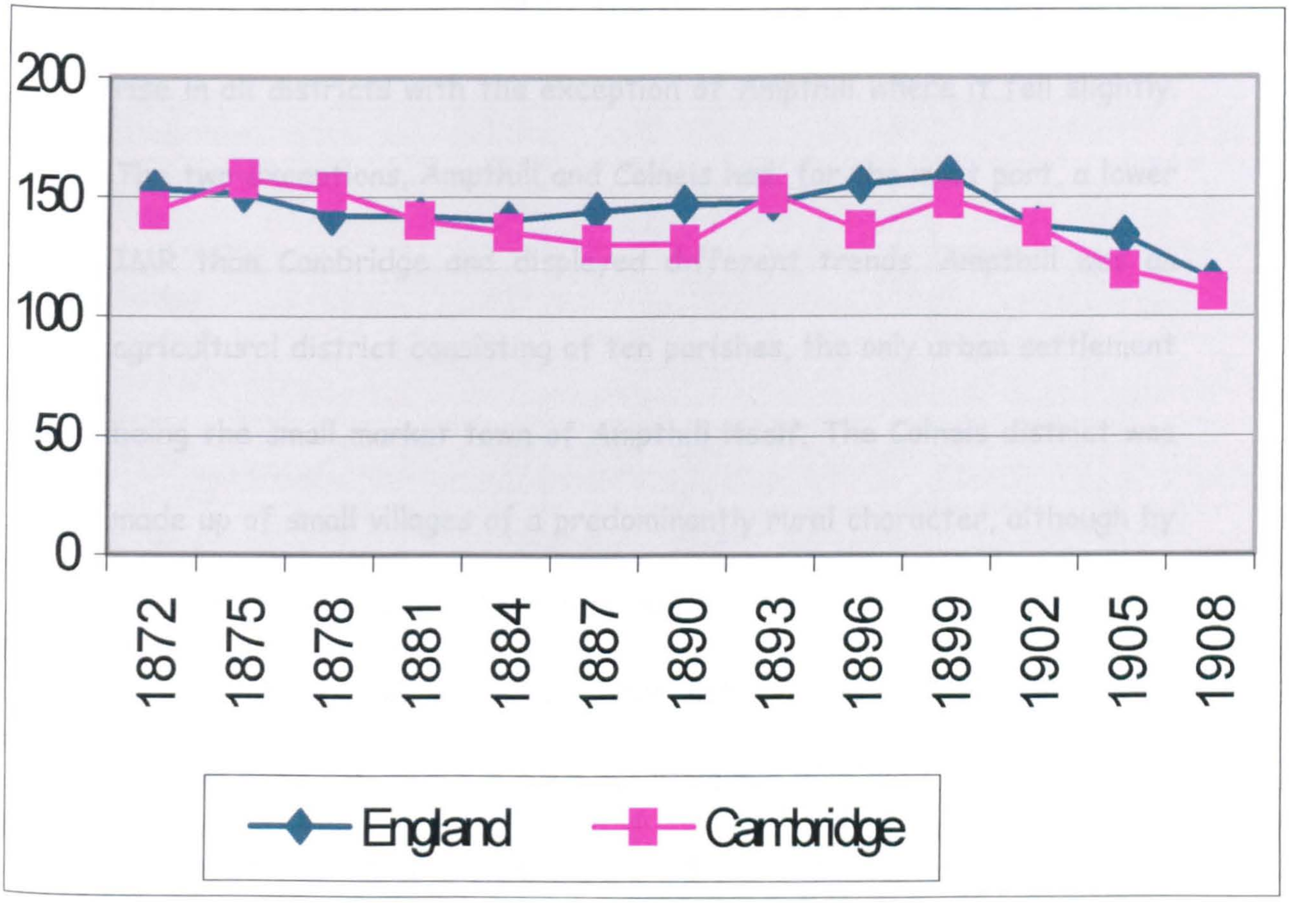
This account has attempted to provide the framework for the later discussion of the impact of the built environment and of parental occupation on infant mortality. It will be suggested that the presence of the University had a greater influence on Cambridge than its numbers would suggest. This was partly because of its wealth and partly because it had certain legal powers over the population as a whole. Within any town there are social divisions but within Cambridge there were also divisions between the University elite and the elite of the Town. What is important about these social divisions is that whereas in many other towns in the late 19th century the middle classes were coming together in a string of initiatives likely to impact favourably on the IMR, in Cambridge this would appear to have been less likely because the middle class was split between two groups that had little communication with each other. The relationship between these two elites is discussed in Chapter 8 when the emergence of initiatives likely to impact on infant mortality will be explored.

Chapter 4: Infant mortality in Cambridge: some preliminary findings

Infant mortality trends

Chart 4.1 shows that the general trend of the infant mortality rate (IMR) for Cambridge was very similar to that for England and Wales as a whole over the 1871-1909 period. In the 1870s, however, it was slightly higher. Then it fell below the national average only to rise slightly above it again in the mid 1890s (but see below on the validity of these figures). It seems then that from 1881 onwards the health of infants in Cambridge improved relative to that of the country as a whole. It should be borne in mind, however, that the comparison of local statistics with national ones is of relatively little value because the national picture is a composite of all areas including the supposedly healthier rural areas and the supposedly unhealthy urban ones. As the 19th century progressed the number of births in rural areas became smaller than those in the big towns, so the national picture became weighted towards the 'unhealthy' areas (Williams and Mooney, 1994: 186)

Chart 4.1: IMR England and Cambridge: 3 year moving average 1871-1909



Source: Registrar General's Returns

The rise in the IMR in the 1890s was noted by contemporaries and has been commented upon more recently by historians (WWW, 1989). The decadal average IMR is here compared to that in nine of the registration districts covered by the Open University Infant Mortality Project over the period 1870-1910 (Table 4.1). In all nine districts the decadal average in the 1900s was lower than that in the 1870s, the fall being greater in some districts than in others. It was in the intervening two decades where exceptions were apparent. The decadal average was lower in the 1880s that in the 1870s in all the districts with the exception of Colneis, where it was marginally higher. The fall in the 1880s was followed by a rise in all districts with the exception of Ampthill where it fell slightly. The two exceptions, Ampthill and Colneis had, for the most part, a lower IMR than Cambridge and displayed different trends. Ampthill was an agricultural district consisting of ten parishes, the only urban settlement being the small market town of Ampthill itself. The Colneis district was made up of small villages of a predominantly rural character, although by the end of the nineteenth century two of them, Walton and Felixstowe, were becoming urbanised. Both these districts had a greater proportion of their population living in rural surroundings than did Cambridge, which covered only the municipal borough of the town. An explanation for these differing trends could be that Cambridge was an urban area as opposed to the other districts, which, although in parts becoming urbanised, were essentially rural. Although in comparison to these districts Cambridge was more urbanised, if compared with the industrialised towns and cities of the north of England the picture would be different.

Table 4.1: A comparison of the IMR decadal average as calculated by the Registrar General: nine registration districts in the Open University Project.

Sub district	1871- 1880	1881-1890	1891-1900	1901-1910
Norwich Norfolk	187	167	178	139
Fulham	182	167	173	132
Cambridge Cambridgeshire	152	131	145	117
Ampthill Bedfordshire	151	127	123	89
Bungay Suffolk	134	124	128	117
Hollingbourne Kent	122	100	108	96
Bexley	113	109	126	100
Cholsey	112	100	113	88
Colneis	99	103	108	88

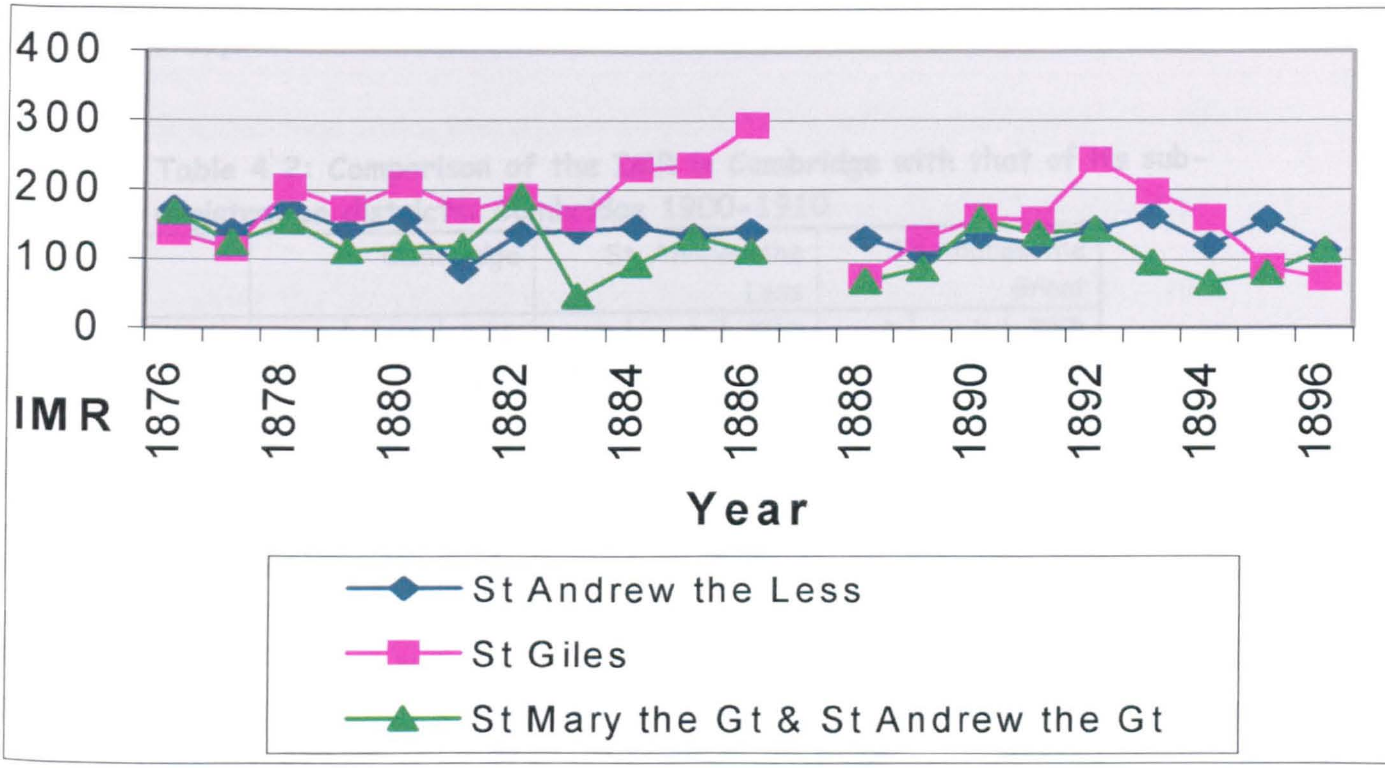
Source: Registrar General's returns compiled by Michael Drake

Is there a difference in infant mortality between registration districts in Cambridge?

Bushell Anningson, MOH 1875-1904, consistently reported that certain areas of Cambridge were less healthy than others. For instance, in his annual report of 1880 he showed that deaths from summer diarrhoea were high in 1876, 1878 and 1880 and that cases were unequally spread across the town, being highest in St. Andrew the Less parish (MOH report 1880: 5-9). In 1882 deaths from infectious diseases were four times higher in the St. Matthew district (part of Barnwell) than in neighbouring St. Paul or St. Mary the Great, a district situated in the town centre. In 1897 the MOH observed an increase in infantile diarrhoea with the distribution of diarrhoea identical with that of previous years (MOH report, 1897: 12). In the following year deaths from infantile diarrhoea were even more numerous and Anningson, the Medical Officer of Health, noted a relationship between persistent high temperature and polluted soil. "The disease showed its usual preference for the special districts mentioned in several of my previous reports" (MOH report 1898: 13).

Data is available in the 1876-1896 MOH reports that allow a comparison to be made of the IMR between areas. For each year in the period 1876-1896 the data is broken down into three areas: St. Andrew the Less, St. Andrew the Great with St. Mary the Great and St. Giles. Chart 4.2 shows St. Giles to be the least healthy area and St. Mary the Great combined with St. Andrew the Great the healthiest. As would be expected, in an area where the annual number of births was by far the greatest, the trend for St. Andrew the Less was smoothest. St. Andrew the Great combined with St. Mary the Great and St. Giles form the registration district of St. Andrew the Great.

Chart 4.2: Comparison of the IMR in 3 sub-registration districts of



Cambridge 1876-96.

Source: Report on the Sanitary Condition of the Borough of Cambridge (MOH report) 1876-1896
Archive Ref. No C51, Cambridge Collection, Cambridge City Library, Lion Yard

In 1876 there were twice as many births in St. Andrew the Less as in the other three areas put together. By 1896, despite only a slight rise in the number of births in St. Andrew the Less, they comprised five times as many as those in the other three areas, due to a fall in the number of births in the other three areas, due to a fall in the number of births in the latter. The ratio between St. Andrew the Less and the rest of

Cambridge remained at 5:1 throughout the rest of the period of this study.

Table 4.2: Comparison of the IMR in Cambridge with that of its sub-registration districts: Cambridge 1900-1910

	Cambridge			St. Andrew the Less			St. Andrew the Great		
Year	B	D	IMR	B	D	IMR	B	D	IMR
1900	923	122	**132**	778	106	**136**	145	16	**110**
1901	794	101	**127**	681	90	**132**	113	11	**97**
1902	842	114	**135**	697	94	**135**	145	20	**138**
1903	884	96	**108**	736	78	**106**	148	18	**122**
1904	819	107	**131**	702	91	**130**	117	16	**137**
1905	891	70	**78**	752	58	**77**	139	12	**86**
1906	791	101	**128**	660	80	**121**	131	21	**160**
1907	816	72	**88**	702	62	**88**	114	10	**88**
1908	791	112	**141**	672	97	**144**	119	15	**126**
1909	854	71	**83**	724	57	**79**	130	14	**108**
1910	824	61	**74**	702	57	**81**	122	4	**33**

Source: MOH reports of Cambridge 1900-1910; Archive Ref. No C51, Cambridge Collection, Cambridge City Library, Lion Yard

Using the number of births and deaths recorded by the MOH the chronological comparison between districts is continued in Table 4.2, for the years 1900-10. Due to changes in the presentation of statistical information by the MOH in the years 1897-1899, the IMR for each of the four areas cannot be calculated. This is because although the MOH recorded the number of infant deaths in each of the four areas (St. Andrew the Less, St. Andrew the Great, St. Mary the Great and St. Giles), he did not record the number of births. Data is, however, available for the registration districts from 1900. As already noted the ratio of births between the two districts remained at 5:1 throughout this period. Using the conventional method of calculation (see Chapter 2) we find that in Cambridge there was an overall decline in infant mortality over the 10-year period. When the two districts are compared with Cambridge St. Andrew the Less showed a similar trend but St. Andrew the Great, with a much smaller population showed a greater fluctuation. This is because one extra death, in a numerically small cohort of infants, results in a higher IMR than would be the case in a cohort five times greater. The mortality rate, in St. Andrew the Great, reached a peak, of 160, in 1906. By 1910 the rate was only 33 deaths per 1000 live births. Despite an overall decline in infant mortality in Cambridge from the start of the ten-year period to the end this was not the result of a gradual decline. In fact in 1902 and 1908 the rate was higher, in Cambridge as a whole, than in 1900, with a similar picture in St. Andrew the Less.

As described in Chapter 2 the Vaccination Birth Registers can be used to construct a life table or survival analysis (see appendix 1 for life tables). The q(90days) measure is the likelihood of an infant dying in the first three months of life and Table 4.3 shows the q(30 days) measure for 1905-11 for St. Andrew the Less, St. Andrew the Great and Cambridge Borough. In this period the likelihood of an infant not surviving to the end of its third month of life was greatest in 1908. Infants were also more vulnerable than average in the first months of life in the years 1907,1909 and 1911.

Table 4.3: Life table q(30 days) measure, Cambridge 1905-11

	1905	1906	1907	1908	1909	1910	1911	1905-11
St. Andrew the Less	0.0214	0.0211	0.0325	0.0381	0.0279	0.0268	0.0335	0.0286
St. Andrew the Great	0.0286	0.0413	0.0085	0.0650	0.0635	0.0102	0.0377	0.0373
Cambridge	0.0225	0.0242	0.0340	0.0424	0.0332	0.0248	0.0341	0.0299

Data source: Cambridge Vaccination Registers 1905-1911

When the IMR for the period 1905-1910 (see Table 4.2) is compared with the q(30days) measure (see Table 4.3) the two are seen to follow rather different paths. The chance of an infant reaching its first birthday was greatest in 1905, 1907, 1909 and 1910. One would expect that in those years the q(90days) measure would be lower but it was so only in 1905. this shows the importance of mortality in the later months of the first year of life e.g. the impact of diarrhoea at 4 to 6 months of age. The q(30days) measure, for Cambridge as a whole, rises in 1907 when the IMR fell. This rise was due to an increase in mortality in St. Andrew the Less compared with 1906, while at the same time St. Andrew the Great experienced a dramatic fall. It is only in 1908 when the infant is considered most vulnerable according to both measures. An explanation for this apparent discrepancy in the findings is that in the first months of life the causes of infant mortality differ from those in later infancy. Age specific trends in infant mortality are further explored in the next chapter.

In Cambridge did the personal factors of date of birth, gender, legitimacy and parental occupation have an impact on infant mortality?

Infant mortality by gender

The mortality level for different age periods can be estimated using the life table with the q (30days) measure being used to compare mortality in the first month of life by gender.

Table 4.4: *Comparison of q(30Days) measure by gender, Cambridge 1905-11*
(Note: appendix 2 male/female life tables give details of births and deaths in each year).

	1905	1906	1907	1908	1909	1910	1911	1905-11
Female	0.0207	0.0265	0.0169	0.0291	0.0336	0.0157	0.0343	0.0250
Male	0.0242	0.0222	0.0415	0.0550	0.0352	0.0330	0.0340	0.0348
Ratio male to female	1.17: 1	0.84: 1	2.46: 1	1.89: 1	1.05: 1	2.10: 1	0.99: 1	1.39: 1
All	0.0225	0.0242	0.0340	0.0424	0.0332	0.0248	0.0341	0.0299

Source: Cambridge Vaccination Registers 1905-1913

Table 4.4 shows that with the exception of 1906, and marginally in 1911, male infants were more likely to die in the neonatal period than were female infants. Differences between male and female infant mortality rates have been noted previously (Woods, Williams, Galley 1997). An American study of neonatal mortality in 1970 also demonstrated 'this male disadvantage'. In this study the ratio of male neonatal death to female neonatal death being 1.28:1 (Naeye, Burt, Wright, Blanc, and Tatter, 1971). In Cambridge over the period 1905-11 the ratio of male to female deaths was 1.39:1. In particular female infants had a much better life chance in 1907 (Ratio 2.46:1), 1908 (1.89:1) and 1910 (2.10:1). It was noted above that whilst the IMR fell in 1907 the q(30 days) measure rose. It seems that this was largely due to an increase in male deaths in St. Andrew the Less.

Table 4.5: Comparison of q(90Days) measure by gender, Cambridge 1905-11

	1905	1906	1907	1908	1909	1910	1911	1905-11
Female	0.0382	0.0526	0.0534	0.0492	0.0516	0.0295	0.0466	0.0458
Male	0.0555	0.0627	0.0548	0.0883	0.0556	0.0482	0.0652	0.0612
Ratio male to female	1.45: 1	1.19: 1	1.03: 1	1.79: 1	1.08: 1	1.53: 1	1.4: 1	1.34:1
All	0.0470	0.0579	0.0540	0.0691	0.0537	0.0393	0.0552	0.0537

Source: Cambridge Vaccination Registers 1905-1912.

Table 4.5 shows as regards chance of dying in the first 90 days of life, males were disadvantaged in each year in the period 1905-1911, the ratio of male to female deaths being 1.34: 1. There was little difference in the years 1907 and 1909 between males and females but in all other years male infants were more likely to die in the first 3 months of life than their female peers, the greatest difference being in 1908, with a ratio of 1.79 male deaths to 1 female death.

Table 4.6: Comparison of q(90Days) - q(30days) measure by gender, Cambridge 1905-11

	1905	1906	1907	1908	1909	1910	1911	1905-11
Female	0.0175	0.0261	0.0365	0.0201	0.018	0.0138	0.0123	0.0208
Male	0.0313	0.0405	0.0133	0.0333	0.0204	0.0152	0.0312	0.0264
Ratio male to female	1.79:1	1.55:1	0.36:1	1.66:1	1.13:1	1.17:1	2.54:1	1.27:1
All	0.0245	0.0337	0.02	0.0267	0.0205	0.0145	0.0211	0.0238

Source: Cambridge Vaccination Registers 1905-1912.

It can be seen in Table 4.6 that the male disadvantage observed in the first month of life (Table 4.4) is continued into the 2nd and 3rd months. that is except in the year 1907. It was in 1907 that, in the first month of life, male infants were most disadvantaged, being almost two and half times more likely to perish than their female peers. Table 4.5 shows that, in the first three months of life, in the years 1907, 1909 and to a lesser extent in 1906 the male disadvantage was only marginal. The Vaccination

Birth Registers do not give any clues as to why, in 1907, the first month of life was particularly dangerous for male infants. Deaths were fairly evenly spread throughout the year and there was no residential pattern to the occurrence of death. Only one set of twins and one illegitimate infant were in the cohort dying before they reached the end of the first month of life. In contrast, in 1911, male infants were two and a half times more likely to die in the 2nd and 3rd month of life than their female peers whilst in the first month of life the likelihood of dying was the same for males as for females. These variations could be explained by male vulnerability to different causes. What is certain is that over the seven year period male infants were more disadvantaged than their female peers in the first month of life, a ratio of 1.39:1 and to a lesser extent in the second and third months of life (1.27:1). Although individual years show variations, which it seems likely to be due to particular causes of death, overall males are less likely to survive the first three hazardous months of life than their female peers. Gender differences are explored further in Chapter 5 as are differences between age at death and possible causes of them.

Infant Mortality - twins and multiple births

Of the 5688 infants born in Cambridge in the period 1905-11 5581 were singleton births, 104 were twin births and 3 were triplets. One in every 53 infants was a twin or multiple birth. The q(30days) measure for the 5581 singletons was 0.0258 whilst that for the fifty-two sets of twins and one of triplets (107 infants) was 0.2385. Thus the risk of death in the first month of life for twins or triplets was 9.2 times greater than for singleton births. Reid who was dealing with a cohort more than five times greater than the Cambridge one, found that the risk was more than eight times greater (Reid, 2001). Recently a retrospective national study was carried out on all singleton and twin birth and death registrations in England and Wales from 1982-91. This showed that although twins were at an increased risk of infant death compared to singleton births the risk was due, in part, to lower birthweight and gestational age at delivery (West, Adi, Phaoroah, 1999).

Infant Mortality by legitimacy

Illegitimate infants made up 4.8% of all births in Cambridge in the period 1905-1911. In 1908 the Medical Officer of Health for Cambridge reported the difference between the infant mortality rate for illegitimate infants and that for legitimate infants. Apart from reporting the cause of death for illegitimate infants no further comment was made on the difference in mortality levels. Nine deaths among illegitimate infants were registered and the cause of death ranged from immaturity and respiratory illness to whooping cough (MOH report 1908: 12). At the time the disadvantage of babies born outside marriage was also being raised as a national issue. The Cambridge Medical Officer of Health, in his annual reports, continued to make a comparison between the mortality rate for legitimately born infants and those born illegitimately until 1910. Table 4.7 records his findings using the conventional IMR for the period 1906-1910. The table shows that illegitimate born infants started life with a significantly worse life chance than their legitimately born peers.

Table 4.7: Comparison of the IMR by legitimacy, Cambridge 1906-10

0Births	1906	1907	1908	1909	1910
No. of deaths of illegitimate infants	7	9	9	8	4
Legitimate	125	81	129	78	75
Illegitimate	175	319	257	163	95

Source: Medical Officer of Health Report, Cambridge 1910: 15

The Vaccination Birth Registers record 276 illegitimate births in the period 1905-11. As the number of illegitimate births was low in comparison to legitimate births, 5412 in the same period, one death could result in a dramatic swing in the annual IMR. It would then be unwise to draw any firm conclusions from this data. Death from prematurity is more likely to occur in the first months of life when the infant is more vulnerable due to low birth weight and feeding problems. Therefore as the MOH gives prematurity as one of the major causes of death for illegitimate infants it is worth comparing mortality using both the q(30days) and q(90days) measure.

Table 4.8:Comparison of q(30Days) measure by legitimacy, Cambridge 1905-11.

	1905	1906	1907	1908	1909	1910	1911	1905-11
No. of illegitimate births	48	39	37	34	44	38	37	276
Illegitimate	0.0000	0.0769	0.0270	0.0294	0.0455	0.0000	0.0270	0.0588
Legitimate	0.0238	0.0215	0.0292	0.0430	0.0265	0.0260	0.0352	0.0250

Source: Vaccination Birth Registers 1905-1912

Based on the evidence that is presented in the MOH reports that infant mortality was greater in illegitimate infants than among their legitimate peers one would expect that when the q(30day) measure for illegitimate infants was compared with that for legitimate infants the legitimate infants would fare best. It would seem that the reverse was true (Table 4.8). Not one of the 48 infants, born in 1905, or one of the 38 born in 1910 died in the first month of life. This is probably a 'small number' problem, where one death makes all the difference. When the period

1905-11, with a sizeable number of illegitimate infants, is considered then illegitimate infants do not fare as well. These results should be treated with caution because there were low numbers of illegitimate infants and one death can make a difference to the results.

Table 4.9:Comparison of q(90Days) measure by legitimacy, Cambridge 1905-11.

	1905	1906	1907	1908	1909	1910	1911	1905-11
Illegitimate	0.0250	0.1737	0.0915	0.1026	0.1026	0.0294	0.0270	0.0933
Legitimate	0.0483	0.0521	0.0531	0.0663	0.0452	0.0398	0.0608	0.0464

Source: Vaccination Birth Registers 1905-1912
Note the number of illegitimate birth used in this table is the same as that in Table 4.8

When the q(90days) measure is used (Table 4.9), the illegitimate infants again fare well in 1905 and 1910. The annual number of illegitimate births was low so that when the calculations are made for the period 1905-11 as a whole a more accurate picture emerges. The illegitimate infant was disadvantaged in comparison to legitimate infants.

Reid found that illegitimacy was a major influence on post neonatal and child mortality (Reid, 1999 & 2001). She confirmed previous work that suggested that neonatal disadvantage was not significant (Wrigley 1977) but the Cambridge findings indicate otherwise. Illegitimacy is discussed further in chapters 5 and 6.

Seasonal variation

The annual IMR hides any seasonal variation in rates; rates that may indicate different causes of death. For instance a rise in the number of deaths in the warm summer and autumn months is more likely to be due to epidemic diarrhoea than any such rise in the winter months. Winter deaths are more likely to be due to respiratory disease, the result of cold and damp. Craig identified a link between climate and cause of infant death in her analysis of infant mortality data for Cambridge from 1876 - 1913. She noted an increase in deaths from diarrhoea in the summer months and a rise in respiratory disease in the winter (Craig, 1995: 23). This supposition that climate was a factor in the transmission of certain diseases will be investigated in the next chapter using cause of death data from the MOH reports and the Registrar General's Quarterly statistics. Table 4.10 shows that, in Cambridge, the IMR was more likely to be at its highest peak, in either the first or third quarter of the year. In 1885 the third and fourth quarters tied as the peak quarter and are not included in the table. Diarrhoea and respiratory diseases were not the only causes of infant death but they were more closely related to seasonal variation.

Table 4.10: Timing of highest level of quarterly IMR: Cambridge 1871-1910

Quarter	Peak qtr.
1 (Jan-Mar)	15 occasions
2 (April-June)	2 occasions
3 (July-Sept)	19 occasions
4 (Oct-Dec)	3 occasions

Source: Registrar General Quarterly Reports
Note : 1885 is not included; see text.

Infant mortality by parental occupation

Parental choice as to where to live is constrained by income, which is related to occupation. Essentially there are two ways of classifying nineteenth century occupational data. The first is to allocate the occupations into industrial groups concerned with the end product of the service and the second to group according to income and social standing. Mills states that, "For many purposes the two most authoritative schemes are those of Tillott and of Booth, reworked by Armstrong" (Mills, 1982: 19). Both schemes are based on industrial groupings Tillott's scheme has widespread uses and Booth's has the advantage of corresponding more or less exactly with the printed census reports (Mills, 1982: 19).

The second method for classifying occupational data is the Registrar General's Social Class Scale which first appeared in his annual report for 1911. Here it was "used as a tool for analysing differential infant mortality rates" (Sapsford, 1999:144). Sapsford argues that "The classification was never based on formal analysis and applied research but was devised 'from the armchair' to reflect current thinking about the relative standing of occupations and their lifestyle" (Sapsford, 1999:144). The Registrar General's Social Class Scale has continued to be used by government departments, with modifications over time, the most recent in 2001 combining it with a Socio-Economic Classification (www.statistics.gov.uk). One criticism of the Registrar General's system is that it overlooks the distinction between different types of middle class occupations (Sapsford, 1999:144), Sapsford suggests that a Socio-Economic Classification such as the Hope-Goldthorpe Scale overcomes this problem by separating the types of employment in the middle range into the following groups: routine non-manual, small proprietors and the self employed, foremen and technicians (Sapsford, 1999:145). Tillott used thirteen groups, some of which were sub-divided. His groups were based on an occupational or industrial classification but were sub-divided using a social status approach (Mills, 1982: 36). Analysis of occupational data drawn from the Vaccination Birth Registers (Table 4.12) is based on Tillott's groups.

Analysis of parental occupation of the 889 infants whose details were recorded in the 1905 Vaccination Birth Registers showed that there were 189 different occupations listed. The occupation of the father was counted except in the case of an infant born outside wedlock and then the occupation of the mother was included. Of these 189 occupations 106 were carried out by more than one person. Table 4.11 shows the occupations in which more than 10 parents of infants born in 1905 were employed. No men were occupied as domestic servants and it was the only occupation where in which more than 10 mothers were occupied. In the case of twin births the occupation of the parent was only counted once. Although there were 189 occupations recorded more than half the parents, recorded in the Vaccination Birth Register as head of household, worked in just 16 occupations (Table 4.11).

Table 4.11 Most frequently reported parental occupation of infants born in 1905, Cambridge

Occupation	No. parents employed
Labourer	225
Carpenter	22
Porter	20
Painter	20
Domestic (mother)	19
Grocer	17
Butcher	17
Bricklayer	17
Fireman	15
Tailor	14
Baker	14
Carman	13
Policeman	12
Compositor	11
Blacksmith	10
Clerk	10
Total	456

Source: *Cambridge Vaccination Birth Registers* 1905-06

The occupational structure of Cambridge was discussed in Chapter 3 and it was indicated there that the male population were largely employed in the following categories: the building trade, the production of goods including the University Press, service occupations, and the railway and in an unskilled capacity in all trades. This is reflected in this analysis of the 1905 data where the predominant male occupations fell into seven categories.

Unskilled - labourers

Retail - grocer, butcher, baker

Building trade - carpenter, painter, bricklayer

Production of goods - tailor, blacksmith, compositor

Railway - porter, fireman

Service - policeman, carman

Clerical - clerk

Table 4.12: Parental occupation of infants born 1905-11, Cambridge

Tillott's Group	% employed
Agricultural self employed or managers	0.2
Skilled agricultural workers and agricultural labourers	0.6
Shopkeepers, traders and petty entrepreneurs	13.7
Skilled craftsmen, non-industrial	15.3
Manufacturers, industrialists, wholesalers or mangers of large enterprises, skilled industrial craftsmen	2.6
Extractive industries	0
Professional	4
Clerical	1.9
Servants	7.9
Private income and rentiers	0.4
Semi-skilled and service workers	20.2
Labourers and unskilled workers	30.7
Supervisory workers	1

Source: Cambridge Vaccination Birth Registers 1905-1912

The figures in Table 4.12 are for the 5688 births recorded in the Vaccination Birth Register in the period 1905-11. On sixty one occasions (1%) no occupation was recorded. No account is taken of the fertility of different occupational groups. Therefore some occupations may be over-represented relative to their presence in the general population. No adjustment has been made for twin or multiple births. In the case of illegitimate infants mother's occupation is not recorded as a separate group but added to the appropriate occupation group.

When the seven categories of the most frequently occurring male occupations identified in the 1905 Vaccination Birth Registers are compared with Tillott's groupings the building trade workers and the producers of goods are 'lost' in the skilled craftsmen category. The railway workers, defined by Edwards (see Chapter 3) as a new group of workers not dependent on the University are also lost in Tillott's semi-skilled and service workers category. In the case of an illegitimate birth the mother's occupation is used and these figures are 'lost', in other categories, most frequently in the servant category. For these reasons a more appropriate classification system has been developed. This takes into account the economic structure of Cambridge, and the source of the data. This classification system is used to compare infant mortality in Cambridge by occupational category (Table 4.13 and 4.14). The Vaccination Birth Register data for 1905-1911 is used to calculate the conventional IMR (Table 4.13) and the mortality rate at 30 days and at 90 days (Table 4.14)

The following groups are used:-

PRODUCERS - includes Tillott's agricultural groups, skilled craftsmen (not including those employed in the building trade) and manufacturers (not including printers).

BUILDING TRADE

PRINTING TRADE

RETAIL – includes shopkeepers and traders

SERVICE PROVIDERS - includes service workers (not including railway employees) and servants (not including maternal occupation in the case of illegitimate birth)

RAILWAY EMPLOYEES

LABOURERS

CLERICAL and MANAGERS combined to form white collar group

PROFESSIONAL

MATERNAL OCCUPATION - in the case of an illegitimate birth

NO OCCUPATION RECORDED

Using the conventional method to calculate IMR it can be seen in Table 4.13 that families with a head of household employed in a professional capacity fared best and those with a mother as a head of household fared worst. When the mortality rate is calculated at 30days (Table 4.14) the group with a labourer as head of household fare worse than those with a mother as head.

Table 4.13: IMR by Occupational category, Cambridge 1905-11

Occupation	Birth	Deaths	IMR
Producer	680	54	79
Building trade	602	45	75
Printing trade	96	3	31
Retail	929	60	65
Service provider	815	59	72
Railway employee	349	13	37
Labourer	1500	154	103
White collar	157	9	57
Professional	222	5	23
Mother	257	34	132
No occupation	61	7	115
Total	5668	444	78

Source: Vaccination Birth Registers, Cambridge 1905-1911

The occupational group that fared best at 30 days was that headed by a father working in a trade linked to the railway. By 90 days the railway employees were still the healthiest group and those households headed by a mother were the unhealthiest.

Table 4.14: Mortality Rate at 30 days and 90days by Occupational Category, Cambridge 1905-11.

Occupation	q(30days)	q(90days)
Producer	0.0324	0.0565
Building trade	0.0233	0.0646
Printing trade	0.0104	0.0238
Retail	0.0280	0.0514
Service provider	0.0319	0.0518
Railway employee	0.0086	0.0123
Labourer	0.0393	0.0701
Clerical	0.0294	0.0527
Manager/supervisor	0.0182	0.0607
Professional	0.0135	0.0295
Maternal occupation	0.0350	0.0820
No occupation	0.0164	0.0594

Source: Vaccination Birth Registers, Cambridge 1905-1911

When the findings in both table 4.13 and 4.14 were compared the three healthiest groups, in all cases, were the railway employees, those employed in printing and professionals. Two groups were the unhealthiest in all measures, families headed by a labourer and those by a single mother. This information suggests that family income was a significant factor in the life chances of an infant. This is considered in more detail in Chapter 7 when family income and housing are investigated.

Seasonal variation in mortality was considered above and here in Table 4.15 the number of infant deaths by season and parental occupational group are presented.

Table 4.15: Number of infant deaths by season and parental occupational group, Cambridge 1905-11

Occupation	No. of births	Jan-Mar	April-June	July-Sept	Oct - Dec
Producer	54	23	8	5	18
Building trade	45	10	7	19	9
Printing trade	3	1	1	0	1
Retail	60	18	7	17	18
Service provider	59	19	6	19	15
Railway employee	13	4	2	3	4
Labourer	154	42	34	41	37
White collar	9	2	2	4	1
Professional	5	3	1	1	0
Mother	34	10	4	13	7
No occupation	7	1	1	1	4
Total	444	133	73	123	114

***Source*: *Cambridge Vaccination Birth Registers* 1905-1911**

Table 4.15 shows that there is a *seasonal* peak in infant deaths in July to September for illegitimate infants and those with a building worker as head of household. It was shown above that infants born out of wedlock did not fare as well as their legitimate born peers. Since the peak is in the hot summer months and single mothers are more likely to experience poor living conditions then this may be as a result of an increase in deaths from diarrhoea particularly as it is shown in Table 4.13 that these infants fare worse than all their peers at 90 days.

There are troughs in the April to June period for those families where the head of the household is a producer, in the building trade, in the retail trade, or is a service provider. It was shown in Table 4.10 that in the period 1871-1911 the quarter April-June was the least likely to experience a mortality peak. Overall in the period 1905-1911 this same quarter also experienced the lowest number of deaths. Families with producers as head of household also experience a trough in the July to September period. When the deaths in this group of infants are looked at across the year then they experience a higher number of deaths in the colder winter months. Of the 58 producers with an infant born in 1912, in the sub registration district of St. Andrew the Less, 81% (38+ 9) lived in property with RV of over £6 per annum (Table 4.17). This suggests that, at least for those infants, they were living in conditions which did not contribute to the spread of diarrhoea. So, one explanation for the troughs experienced by the infants of families headed by a producer were better living conditions but, on the other hand, this should have protected against deaths from respiratory conditions as well.

Building work is subject to seasonal fluctuations so with greatest work being available in the summer one would expect that if family income influenced infant health then infants would be healthier in the summer months (July to September). Table 4.15, however, suggests that the seasonality of building work did not influence infant mortality since in the summer month's mortality increased rather than decreased. It must be remembered that any period of unemployment affecting family resources could lead to the mother being undernourished during pregnancy, with a consequent deleterious impact on the foetus. The result being that the infant is more likely to be weak, born small for dates and fail to thrive in the first months of life. Infant mortality and parental occupation will be explored further in Chapters 6 and 9 in relation to poverty, housing and nutrition.

Infant mortality and housing

It has been established that some parts of Cambridge were 'less healthy' than others but were some streets within those areas 'less healthy' than others? And if so; in those unhealthy streets were some houses 'less healthy' than others? The Vaccination Birth Registers together with the 1910 Land Tax survey allow the relationship between type of housing and infant mortality to be explored (Table 4.4). The 1912 St. Andrew the Less register is used because, as already discussed (Chapter 2), all deaths of infants born in that parish during the year were recorded. The rateable value of the houses where 437 infants were born was established. Eighty two per cent of these infants lived in property with a rateable value of less than £10. Table 4.16 shows that infants born to families living in properties rated at from £2.10s-£5.10s were twice as likely to die before reaching their first birthday as those born in the £6-£9 properties. The IMR of infants living in properties over £10 was marginally higher than those in properties with a rateable value of £6-£9, but still far lower than that of infants in the cheapest properties.

Table 4.16: IMR by rateable value of property where infant born, St. Andrew the Less, Cambridge 1912

	£2.10s-£5.10s	£6-£9.10s	£10-£41
Born	113	244	80
Died	21	23	9
IMR	186	94	113

Source: 1910 Land Tax Survey
Cambridge Vaccination Births Registers 1912-13.

As infant death registers are available for 1912/13 it is possible to calculate the IMR using the cohort measure, it being assumed that where no death was recorded the infant was still alive at one year of age. No account can be taken of any deaths of vaccinated infants outside Cambridge or of infants now living outside Cambridge who were no longer in observation. The relationship between the rateable value of property and infant mortality is only a rough guide because the majority of families live in the middle rateable value range. However, it does appear that children born into houses with the lowest rateable value did fare particularly badly. Since the ability to rent or own a property of a high rateable value depended to a large extent on the occupation of the main breadwinner the rateable value was compared by occupational group (Table 4.17). Each group of occupations included all workers in that category, no distinction being made as to income. For instance a master butcher, earned more than a butcher's shop assistant, but both were included in the same category. The families included were those where an infant was in 'observation' at 90 days or where an infant died before 90 days. 25.6% of the families lived in property where the RV was between £2 and £5.10s, 56.1% of the families lived in property with a RV of between £6 and £9.10s the remaining 18.3% of families lived in property with a RV of more than £10.

Table 4.17 shows that labourers were more likely to live in the lowest and middle range RV property, whilst professional families were, as expected, more likely to live in the top RV band. In the lowest range band 48% of the families were headed by a labourer whereas only 6% of the families living in the top range band had a labourer as head of household. Those working in retail were more likely to live in the middle and top range bands an explanation for this being that they often lived in the premises where their trading took place and the commercial nature of the premises resulted in a higher RV. Chapter 7 looks at the relationship of housing and infant mortality in more detail.

Table 4.17: *Comparison between occupational group and RV band of house expressed as numbers in each occupational group and the percentage of all houses in band, St. Andrew the Less, Cambridge 1912.*

Occupation	RV £2-£5.10s		RV £6-£9.10s		RV£10 +		Total	
	No.	%	No.	%	No.	%	No.	%
Producer	11	10	38	16	9	11	58	13.3
Building trade	6	5	38	16	6	8	50	11.5
Printing trade	1	1	1	0	2	2.5	4	0.9
Retail	12	11	33	13	26	33	71	16.2
Service provider	12	11	43	18	8	10	63	14.4
Railway employee	8	7	29	12	1	1	38	8.7
Labourer	54	48	50	20.5	5	6	109	24.9
Clerical	0	0	1	0.5	5	6	6	1.4
Manager/supervisor	0	0	0	0	2	2.5	2	0.5
Professional	0	0	3	1	11	14	14	3.2
Mother	7	6	6	2	5	6	18	4.1
No occupation	1	1	3	1	0	0	4	0.9
Total	112		245		80		437	

Source: Cambridge Vaccination Birth Registers 1912
Cambridge 1910 Land Tax Survey

Table 4.17 shows that labourers were more likely to live in the lowest and middle range RV property, whilst professional families were, as expected, more likely to live in the top RV band. In the lowest range band 48% of the families were headed by a labourer whereas only 6% of the families living in the top range band had a labourer as head of household. Those working in retail were more likely to live in the middle and top range bands an explanation for this being that they often lived in the premises where their trading took place and the commercial nature of the premises resulted in a higher RV. Chapter 7 looks at the relationship of housing and infant mortality in more detail.

Conclusion

In this Chapter we set out to address the proposition that an infant's chance of survival was influenced more by where it lived than by any personal or parental characteristic. When infant mortality was investigated by sub-registration district it was shown that an apparent inequality existed. The population of the sub-registration of St. Andrew the Less, the least healthy district, was five times greater than the rest of Cambridge. Despite considerable fluctuation in the IMR over the years the parish of St. Andrew the Great was the healthiest place for an infant to live in the period 1876-1911. The MOH repeatedly reported that Barnwell (part of St. Andrew the Less district) had the most cases of infant diarrhoea, St. Giles, part of the sub-registration district of St. Andrew the Great although socially comparable did not suffer to the same extent. So at least in the case of infantile diarrhoea St. Andrew the Great was a healthier place to live. The MOH identified that in St. Andrew the Less district the 'fall' of the sewer was not as great as that in the St. Andrew Great district. In hot dry weather the contents of the sewer became stagnant, when rainstorms occurred a crack in the sewer pipe meant that the contents soaked into the surrounding soil leading to conditions where infective diarrhoea could be spread by flies landing on the infected soil.

The social profile of St. Andrew the Great was different to that of St. Andrew the Less. This was due to the growth in housing; for the working classes in St. Andrew the Less and for Fellows of the University in St. Andrew the Great. This suggests although environmental characteristics played a part in infant survival parental characteristics were also important. Where a family lived was determined by income which in turn was related to occupation.

The Vaccination Birth Registers allow a robust infant mortality measure, but only for the first three months of life. This was investigated by gender, legitimacy, singleton or multiple births, season of birth and occupation of the father, or a mother in the case of a single parent family. It was established that gender played a part in infant survival in the first three months of life and male infants were more disadvantaged than their female counterparts. Likewise illegitimacy and twin or multiple births disadvantaged an infant in the first three months of life. The risk of death in the first month of life for a twin was 9.8 times greater than that for a singleton birth. We can, then, conclude that these personal characteristics play a part in an infant's chance of survival, at least in the first three months of life. If we had Infant Death Registers for Cambridge earlier than 1912 then we would be able to show whether this disadvantage persisted after three month of age. It was found in Cambridge that illegitimate infants were disadvantaged in the neonatal period; this differed from the findings of others (Reid, 2001 and Wrigley, 1977). It is suggested that, in Cambridge, this disadvantage in the early months of life was because as a single parent the mother was more likely to live in poorer housing conditions.

The environment in which a family lived was determined by family income and it was shown that infants born to families living in property of a rateable value of £2.10s - £5.10s were twice as likely to die as those living in a property with a rateable value of £6-£9. Income was closely linked with occupation. The number of professional families made up a much smaller proportion of families with infants than did families headed by a labourer. Professional families were more likely to live in a higher R.V. banded property. The impact of this small number of professional families was to lower that the IMR overall. This link between where an infant was born and socio-economic deprivation persists even today. The findings in this chapter will be dealt with in more detail in subsequent chapters. At this point it appears that, at least in the first months of life, personal and parental characteristics were more important than environmental characteristics because where an infant lived depended on family income.

Seasonal peaks in infant mortality were identified; illegitimate infant mortality peaked in the summer months as did that of infants born into a family headed by a building worker. There were also seasonal troughs in infant mortality, families headed by retail workers, services providers and builders experienced a trough from April to June. Families where a producer was head of household experienced a trough from April to September. The influences of the season are discussed further in relation to mortality from diarrhoeal disease and respiratory diseases in Chapter 5. Both environmental characteristics and personal characteristics have a bearing on infant mortality and the relative importance of each is discussed further in Chapters, 5, 6 and 7.

Chapter 5: Cause of Death

Introduction

In order to determine the factors contributing to the decline in infant mortality this chapter sets out to explore the causes of infant death and the factors contributing to the spread of those diseases. Using the MOH reports Craig carried out an analysis of causes of infant death in Cambridge between 1876 and 1913. She found that the major causes of death were debility, diarrhoeal disease and respiratory disease (Craig, 1995). Data from the Vaccination Birth Registers, the Annual Reports of the Medical Officer of Health (MOH), and The Registrar General's Quarterly Reports will be drawn upon, with a view to answering this question. Although 1876 was the first full year when the Cambridge MOH reported the number of infant deaths by cause, it was not until 1906 that the age at death was also given. In his reports he frequently refers to the prevalence of infective diarrhoea and discusses potential factors contributing to the spread of the disease. In the twentieth century he devoted a section of his report to infant mortality but he only set out the relative importance of the various causes of infant mortality, he did not speculate on contributory factors. Of the 577 infant deaths in the years 1905-1911 the most frequently occurring cause of infant death was diarrhoea (113 deaths), premature birth led to the death of 107 infants, whilst bronchitis and pneumonia resulted in 102 deaths. A substantial number (107) were classified as other causes (MOH report 1911:15). From the Registrar General's Returns we know in which quarter of the year deaths occurred. From the Vaccination Birth Registers we have the number of deaths before the infant reached three months of age and the quarter of the year, indeed the month, in which they occurred, although unfortunately cause of death was not given.

Classification of Causes of Infant Death

Although the collection of cause of death data was a feature of the general registration system of births, marriages and deaths that began in England and Wales on 1 July 1837 this information did not find its way into either the Vaccination Birth or Death Registers. Szreter (1991) argues that the GRO used this information to produce reports, the aim of which was to raise awareness, amongst both the general public and professionals working in the field of public health, of preventable disease. The intention being to bring about changes that would reduce mortality. Weekly and quarterly reports comparing death rates in the different registration districts engendered competition between those responsible for them (Szreter, 1991: 438). These reports were followed by more detailed analyses of causes of death, which were reported in a series of annual and decennial reports. From this information it is possible to calculate age and cause specific mortality both for individual registration districts and for the country as a whole (Szreter, 1991: 435-437). In each of the three decades 1871-1900 diarrhoea and respiratory diseases were the major causes of infant death in Cambridge. The number of deaths under one year of age was first reported by the Registrar General in 1857 and in subsequent years infant deaths by selected cause were reported annually for the whole country and its various subdivisions. The annual infant mortality rate, i.e. number of infant deaths per 1,000 births was not published by the Registrar General until 1877 (Armstrong, 1986: 212).

There are limitations on the usefulness of cause of death data, because of weaknesses in the classification system (Lee, 1991: 61). Even when a medical practitioner certified cause of death he frequently did so in terms of symptoms rather than actual causes, e.g. "convulsions", "fever", "teething" (Alter & Carmichael, 1996: 44). The problem then is to which category to assign these deaths. For instance is the fever due to infectious diarrhoea or respiratory disease? Even the medical certification of death may not always have resulted in an accurate cause of death since the practitioner may not have seen the infant alive and could only make a diagnosis on the symptoms as described by the relatives (Alter & Carmichael, 1996: 45). The Cambridge MOH reports show that in the period 1906 to 1911 out of 508 infant deaths only 4 were not certified by a medical practitioner (MOH Reports 1906, 1907 and 1911 Appendix Table 5). These deaths occurred in the first week of life and in one case the infant was born prematurely and the cause of death was assigned to prematurity (MOH Report 1906 Appendix 5). The notes to Tables 4 and 5 state that: "All deaths certified by registered Medical Practitioners and all Inquest cases are classed as Certified; all other deaths are regarded as uncertified (MOH Report, 1906: Appendix Table 5)

Another problem with the classification system is that knowledge of disease processes evolves over time and the categories to which a cause of death was assigned changed to take this knowledge into account. Woods and Shelton describe examples of this when they identify the principal causes of infant death in the Victorian period in England and Wales. By the 1890s 'Diseases of the brain' had become 'diseases of the nervous system', 'diseases of the lung' had become 'diseases of the respiratory system', and 'diarrhoea and dysentery' were included in the category 'diseases of the digestive system' (Woods & Shelton, 1997: 53).

Finally, a major problem was that the 'catch all' category 'other' was frequently used when reporting deaths in infancy; as many as one third of infant deaths being assigned to this category (Woods & Shelton, 1997: 47).

Despite these limitations, cause of death statistics together with infant mortality data on age and date of death can be used to explore those factors that predispose to diseases or conditions that result in infant death. Unless otherwise stated the cause of death statistics used in this chapter are derived from the MOH reports for the Borough of Cambridge, rather than from the General Register Office (GRO). They do not include the deaths of non-resident infants, for instance those who died whilst in Addenbrookes Hospital in Cambridge, therefore they provide a more accurate picture of mortality amongst Cambridge-born infants than do the Registrar General' figures. From 1906 onwards the MOH reports give detailed information on age at death from all causes. Here, then, the period 1906-1911, will be considered in detail, whilst the years 1875-1905 will be examined in more general terms. The investigation is not extended beyond 1911 because in 1912 boundary changes resulted in parts of Chesterton, the rural hinterland area of Cambridge, being incorporated into the registration district of the

Borough of Cambridge, thus making comparison difficult (MOH Report 1914:23).

The relative importance of causes of infant and child death

By 1914 it seems that rather than focussing on infant mortality the mortality of children between 1 and 5 years of age was of special interest. The MOH compared causes of death in these two age groups over two decennial periods, 1895-1904 and 1905 - 1914. He commented that the number of deaths of in the first five years of life was five times greater than in any subsequent five year age period until the age of 65 years was reached. In his table the MOH showed that despite an increase in population the number of deaths in the age group one to five years old was practically the same in the years 1895-1904 as it was in the years 1905-1914. The number of infant deaths on the other hand had decreased by some 30% in 1905-1914 despite an increase in population (MOH report 1914:22-23). The table below is drawn from his data and shows the relative importance of causes of death in both age groups, the relative importance of each cause of death is different for each of the age groups but the order hardly changes in the two decennial periods. The most frequently occurring causes of infant death are; congenital conditions and premature birth, diarrhoeal disease, bronchitis and pneumonia. The most frequently occurring causes of child death are infectious diseases, bronchitis and pneumonia and tuberculosis.

Table 5.1: A comparison of causes of infant death and child death in two decennial periods: Cambridge 1895-1914.

	1895-1904		1905-1914	
Cause of death	N of deaths under 1 year	N of deaths 1-5 years of age	N of deaths under 1 year	N of deaths 1-5 years of age
Infectious disease	68	134	54	169
Tuberculosis	49	46	23	45
Bronchitis and pneumonia	173	108	138	87
Diarrhoeal disease	250	36	127	29
Congenital diseases & premature birth	350	14	320	6
Convulsions	64	11	26	13
Meningitis	15	16	10	15
Syphilis	30		11	
Rickets	6	3	1	2
Overlaying	25		15	1
Total N of deaths	1030	368	725	367

Source: MOH report 1914:22

Neonatal Mortality by cause of death: 1906-1911

The MOH, in his reports of 1906-1910, records cause and age of infant death. He used five categories to report these details which were given by week for the first month of an infant's life and then monthly (MOH report, 1906-1910 Appendix Table 5). Subsequent reports continued to give weekly figures for the first month, monthly figures for the second and third month and then for each subsequent three months.

The five categories used by the MOH include the following cases of death:-

1. *Common infectious disease*: smallpox, chickenpox, measles, scarlet fever, diphtheria and whooping cough.

2. Diarrhoeal *diseases*: all forms of diarrhoea, enteritis, muco-enteritis, gastro-enteritis, gastritis and gastrointestinal catarrh.

3. Wasting *diseases*: atrophy, debility, marasmus and want of breast milk. Prematurity and congenital defects are also included in this category.

4. Tuberculous *diseases*: tuberculous meningitis, tuberculous peritonitis, tabes mesenterica and other tuberculous disease.

5. Other *causes*: erysipelas, syphilis, rickets, meningitis (not tuberculous), convulsions, bronchitis, laryngitis, pneumonia,

suffocation or overlaying and all other unspecified causes. By 'unspecified' is meant that although a cause may appear on the death certificate, it does not fit into any of the categories listed.

Although bronchitis, pneumonia and convulsions are included in the 'other causes' category this did not reflect the importance of these diseases as contributory causes to infant mortality (Table 5.1). From 1909 onwards the MOH produced a table giving the relative importance of various causes of infant mortality and the following diseases were included: premature birth, debility, diarrhoeal diseases, measles, whooping cough, convulsions, tuberculosis disease, bronchitis and pneumonia (see Table 5.4).

Table 5.2: Neonatal deaths by cause, Cambridge 1906-1911

Age	Infectious disease	Diarrhoeal diseases	Wasting	Tuberculosis	Other	Total	% of deaths by age	IMR by age
0-6 days			87		23	110	68	22.8
7-13 days			9		2	11	7	2.3
14-20 days	1	5	11		3	20	12.5	4.2
21-28 days		3	11		6	20	12.5	4.2
Total	1	8	118	0	34	161		
% of deaths by cause	0.6	5	73.3	0	21.1			
IMR by cause	0.21	1.66	24.5	0	7.06	33.4		
Total no. births 1906-11	4815							

Source: MOH Annual Reports, Cambridge 1906-1910 Appendix Table 5, 1911 Table 4.

Table 5.2 draws on data reported by the Cambridge MOH it shows deaths from stated causes in weeks for the first month of life (neonatal-mortality) in the period 1906-1911 when the IMR for neonatal mortality was 33.4 deaths per 1000 live births. The table shows that, in Cambridge, 73.3% of neonatal deaths in the period 1906-1911 were the result of wasting disease. The neonatal mortality rate for wasting disease was 24.5 deaths per 1000 live births. The majority of these, 74% (87 deaths) occurred in the first week of life. Of the 118 deaths in the category wasting disease, 74 were the result of a premature birth, 28 due to debility, 12 to congenital disorders and four to injury at birth (MOH reports 1906-1911).

Neonatal deaths in the category 'other causes' made up 21.1% of all neonatal deaths. The mortality rate for these causes was 7.1 neonatal deaths per 1000 live births. Within this category were 15 (44%) deaths from unspecified diseases. Specified causes included, suffocation, or overlying, 8 deaths (23%), convulsions 5 deaths (15%), bronchitis 3 deaths (9%) and pneumonia 2 deaths (6%). The remaining death in this category was due to syphilis.

Diarrhoeal disease accounted for 5% of neonatal deaths and these eight deaths occurred in the second and third week of life. There was only one neonatal death in the category infectious disease and this was as a result of whooping cough. There were no deaths as a result of tuberculosis.

The variations in each year are discussed below in relation to contributory factors to the transmission of disease.

Infant Mortality by age and cause of death: 1906-1910

Table 5.3 shows the age at which infants died by stated cause. Cause of death is assigned to categories as in Table 5.2. Unlike Table 5.2 the period covered does not include 1911 because, as stated above, after the third month the MOH reported on cause of death by three month age groups. In 1911 diarrhoea deaths made up 28% (27 deaths) of all infant deaths in that year, whereas the total percentage of diarrhoea deaths in the period 1906-1910 was 17.6% (72 deaths). The IMR for the period 1906-1910 was 101 per 1000 live births but this figure hid the variations in each year.

Table 5.3: Age of infant at death by cause, Cambridge 1906-1910

Age in months	Infectious disease	Diarrhoeal diseases	Wasting	Tuberculosis	Other	Total	% of deaths by age	IMR by age
Under 1	1	6	99	0	27	133	32.4	32.8
1	1	6	32	1	19	59	14.4	14.6
2	3	13	8	0	12	36	8.8	8.9
3	1	9	2	1	10	23	5.6	5.7
4	3	8	3	0	7	21	5.1	5.2
5	2	8	2	1	4	17	4.2	4.2
6	8	3	4	1	10	26	6.3	6.4
7	2	3	2	1	12	20	4.9	4.9
8	2	5	2	1	11	21	5.1	5.2
9	2	2	2	3	15	24	5.9	5.9
10	1	5	0	1	7	14	3.4	3.5
11	4	4	0	1	7	16	3.9	3.9
Total	30	72	156	11	141	410		
% of deaths by cause	7.3	17.6	38	2.7	34.4			
IMR by cause	7	18	38	3	35	101		
No. of births	4051							

Source: MOH Annual Reports, Cambridge 1906-10 Appendix Table 5
For diseases included in each category see page 155.

The data in Table 5.3 shows that 32.4% of infants dying before reaching their first birthday do so in the first month of life. Almost a half (46.8%) of infant deaths occurred before the infant reached the second month of life. Wasting disease caused the highest proportion of deaths under the age of one year (38%). Two thirds of those who died from diarrhoeal diseases did so before reaching six months of age. This finding differs from that of other studies in which diarrhoea hit hardest *after* the first six months (Reid, 2001). This matter is discussed further in Chapter 9 in relation to infant mortality and the role of breast-feeding in protection from infantile diarrhoea. This discussion will contribute towards the second proposition, which is, that by developing a one to one relationship with women health visitors were a major contributor to the decline in infant mortality. In this case their role in the promotion of breast feeding or safe infant feeding practices will be explored.

The diseases grouped together in the category 'other causes' resulted in 34.4% of all infant deaths in the first year of life. Bronchitis and pneumonia which were included in the is category are dealt with in detail below.

Contributory factors to causes of death

Table 5.4 shows the relative importance of the main causes of infant death in the years 1906-1910. Bronchitis, pneumonia, diarrhoea and the 'failure to thrive' group of diseases were the major causes of infant death in these years.

Table 5.4: The relative importance of causes of death Cambridge: 1906-1910

Cause of death	1906	1907	1908	1909	1910	Total
Premature birth	11	13	21	22	11	78
Atrophy, debility, and marasumus	8	14	18	10	8	58
Diarrhoeal disease	33	10	12	9	8	72
Measles			5			5
Whooping cough	9		12		4	25
Bronchitis and pneumonia	26	20	15	8	14	83
Tuberculosis diseases	2	1	6	3	1	13
Convulsions	2	3	4	4	1	14
All other diseases	10	11	13	15	14	63
Total	101	72	106	71	61	411

Source: MOH report, 1911:15

The major causes of infant death and the age at which those deaths occurred have been identified. Now we move on to explore the factors which contributed to those causes of death and the year in which those deaths occurred. This is important because the contributory factors fall into two categories, environmental factors and personal factors. The first proposition which we set out to test was that the chance of infant survival was determined more by environmental characteristics than by personal and family characteristics. The factors will be examined using the five categories used by the MOH taking into account his ranking of causes of death (Table 5.4) where measles, whooping cough and bronchitis and pneumonia are considered separately.

Infectious disease

In order to identify factors of importance in the spread of disease it is necessary to consider the transmission route of individual diseases. The transmission of those diseases in the MOH category common infectious disease was largely airborne and due to droplet infection. This route spread measles, mumps and whooping cough (Salisbury, Ramsey, Noakes, 2006: 209, 255, 277). Since measles and whooping cough were important causes of infant mortality (Table 5.4) and spread by droplet infection then overcrowding must be a contributory factor to the prevalence of these diseases. Chickenpox and diphtheria were also spread by droplet infection. In addition chickenpox was spread by personal contact and diphtheria by contact with soiled articles (Salisbury, Ramsey, Noakes, 2006: 421, 109). The cutaneaous form of diphtheria was spread by ingestion of raw dairy products or contact with infected animals (Salisbury, Ramsey, Noakes, 2006: 109).

Infectious diseases are cyclical in nature and can contribute to peaks and troughs of infant mortality with the result that they may mask a general trend. Therefore although deaths from infectious disease made up only 7.3% (30 deaths see Table 5.3) of all infant deaths in the period 1906-1910 they still play an important role in any investigation into the decline of infant mortality. During the five year period, 1906-1910, there were no infant deaths from smallpox, chickenpox, scarlet fever or diphtheria. The only causes of death from infectious disease in this period were from measles (8 deaths) and whooping cough (22 deaths).

Table 5.5 gives the age and year of death of the 30 infants dying from these causes. Five of these deaths occurred in 1908 when there was an outbreak of both whooping cough and measles. Such deaths were most likely to occur in the sixth month of life (8 deaths) but deaths occurred in each month throughout the first year of life. There were no infant deaths from these infectious diseases in the years 1907 and 1909.

Children with whooping cough (pertussis) present with "paroxysms of coughing which culminate in either a prolonged inspiratory whoop or in collapse due to hypoxia. The disease is most severe, and morbidity and mortality greatest, in infants under six months of age" (Barnes and

Roberton, 1981: 45). Table 5.4 shows that 15 of the 22 infant deaths from whooping cough occurred in infants six months old and younger. Whooping cough may be complicated by bronchopneumonia, weight loss following repeated vomiting and brain damage as a result of lack of oxygen to the brain (Salisbury, Ramsay, Noakes, 2006: 227).

Table 5.5: Infant deaths from measles (M) and whooping cough (W) by age at death, Cambridge 1906-1910

Age in months	Cause	1906	1907	1908	1909	1910	Total
Under 1	**M**						
Under 1	W	1					1
1	**M**						
1	W			1			1
2	**M**						
2	W	2		1			3
3	**M**						
3	W					1	1
4	**M**			**3**			**3**
4	W	2					2
5	**M**						
5	W	3					3
6	**M**			**2**			**2**
6	W	1		3			4
7	**M**			**1**			**1**
7	W						
8	**M**						
8	W			2			2
9	**M**						
9	W			1		1	2
10	**M**			**1**			**1**
10	W						
11	**M**			**1**			**1**
11	W			1		2	3
Total		9	0	17	0	4	**8 M** 22 W

Source: Cambridge MOH reports, Appendix Table 5 1906-1910

The diagnosis of whooping cough could be confused with other respiratory conditions, for instance in infants and children "the commonest cause of upper respiratory tract obstruction is due to infective croup" (Barnes and Roberton, 1981: 108). In infancy infective croup is the result of a viral infection, often of the para-influenza group and commonly presents as acute laryngotracheobronchitis. This usually occurs between 3 months and 3 years of age and may result in airway obstruction due to the swelling of the upper respiratory tract tissues, which without treatment leads to death (Barnes and Roberton, 1981: 36).

Measles is an acute viral illness and the commonest complications are middle ear infection, pneumonia, diarrhoea and convulsions. Even in the twenty first century case fatality ratio is high in children under one year of age and complication highest in poorly nourished children. Cases of measles peak every two years (Salisbury, Ramsay, Noakes 2006: 209-19). Table 5.5 shows that the eight deaths from measles in the five year period 1906-1910 all occurred in 1908, these infants were four months of age and older. Although 1911 falls outside the five year period we are discussing there were a further 8 deaths from measles in that year. Although measles cases peaked every 2 years, mortality rates from the disease appear to have run on a different cycle.

Diarrhoeal diseases

The second category, diarrhoeal diseases, were spread either by the faecal-oral route or were waterborne by way of faecally contaminated drinking water. The spread of infantile diarrhoea was largely the result of ingestion of contaminated milk, the role of the health visitor in promoting safe infant feeding practices is discussed in Chapter 9 in relation to the second proposition. The transmission of diarrhoeal disease, like the transmission of infectious disease was external to the body and as such the spread of these diseases was enhanced by exogenous factors e.g. overcrowding. Therefore the spread of these diseases could, to some degree, be prevented.

Infant mortality from diarrhoeal diseases also varied from year to year. Certain meteorological and environmental conditions - hot dry weather and poor sanitation - were conducive to the spread of infantile diarrhoea, with the result that the number of cases varied from year to year and place to place. Researchers have also demonstrated an urban/rural differential in infant mortality from diarrhoea (Woods, Watterson & Woodward 1989, Lee, 1991; Williams & Mooney, 1994; Williams & Galley, 1995). Long hot dry summers together with poor sanitary conditions encouraged the spread of the disease and a series of such years were said to have kept infant mortality levels high in the 1890s. Woods, Watterson and Woodward argue that "If the diarrhoea component of infant mortality is ignored because it was critically influenced by short-run meteorological variations, then the underlying long-run trend of infant mortality began to move downward from 1891" (WWW, 1989: 124). Williams suggested that without the increases in diarrhoea in the late 1890s it could be argued that the IMR had been falling gently since the 1860s (Williams, 1989).

Table 5.6 gives the diarrhoea IMR in Cambridge from 1876-1911. It shows a run of elevated rates in the late 1890s but also indicates that there were peaks in deaths from diarrhoea into the twentieth century, in particular in 1904, 1906 and 1911. This finding agrees with that of other authors. Pooler noted a peak in the IMR in England after the long hot summer of 1911 (Pooler, 1918: 4). WWW noted secondary peaks in infant mortality in four urban areas in the years 1904, 1906 and 1911 (WWW, 1988: 364). They also noted that in 1911 epidemic diarrhoea had a short term influence on infant mortality rates (WWW, 1989: 130).

Table: 5.6 IMR from diarrhoea, Cambridge 1876-1911

Year	IMR	Year	IMR	Year	IMR	Year	IMR
1876	33	1886	24	1896	14	1906	42
1877	14	1887	18	1897	26	1907	12
1878	32	1888	9	1898	35	1908	15
1879	0	1889	6	1899	43	1909	11
1880	29	1890	16	1900	30	1910	10
1881	14	1891	10	1901	0	1911	35
1882	10	1892	11	1902	13		
1883	17	1893	50	1903	13		
1884	23	1894	9	1904	28		
1885	7	1895	22	1905	16		

Source: Medical Officer of Health Annual Reports, Cambridge 1876-1911

Table 5.3 gave details of the age at which infants died from diarrhoeal diseases, 1906-1910, but it did not give these details by year. The MOH reports gave details on age of infant death, for these years and Table 5.7 gives the age of death from diarrhoeal diseases in each of the 5 years.

For the years 1904 and 1911 the MOH does not report diarrhoeal disease by age at death in a monthly form. In 1904 the yearly total of deaths was reported together with those under one month of age, in that year there were 26 deaths from diarrhoea in infants under one year of age and three of these occurred in the first month of life. In 1906, a peak year for infant mortality from diarrhoeal disease, deaths occurred at each age, except those under one month. In 1911, another peak year for infant deaths (35 deaths) from diarrhoea, the MOH grouped age at death by three monthly groups and diarrhoea deaths in that year occurred in each of the age groups. Nationally diarrhoea deaths were high in 1911, the weather conditions in the summer were conducive to the spread of the disease providing an explanation for deaths in each age group as all infants were more vulnerable as the incidence of the disease was high.

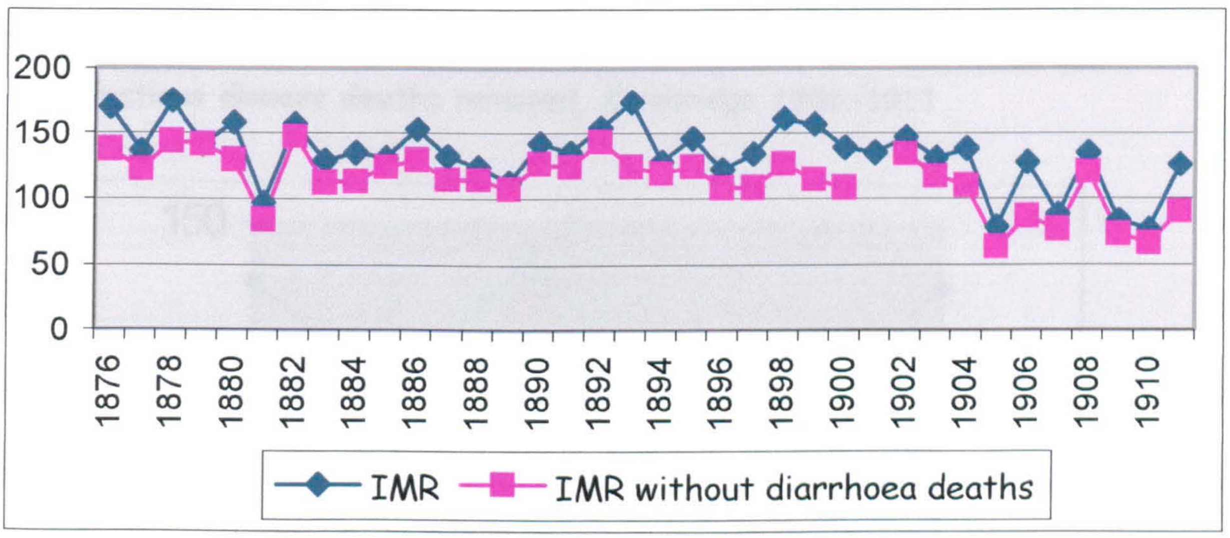
Table 5.7: Infant deaths resulting from diarrhoeal disease by age at death, Cambridge 1906-1910

Age in months	1906	1907	1908	1909	1910	Total	%
Under 1		2	2		2	6	8
1	4	1		1		6	8
2	6	1		4	2	13	18
3	5	1	3			9	13
4	2	1	4	1		8	11
5	2	1	3	2		8	11
6	2	1				3	4
7	1	1			1	3	4
8	2			1	2	5	7
9	2					2	3
10	3	1			1	5	7
11	4					4	6
Total	33	10	12	9	8	72	100
No. of births	791	816	791	854	799	4051	
IMR for diarrhoeal diseases	42	12	15	11	10	18	

Source: MOH reports, Cambridge 1906-1911 Appendix Table 5

When infant mortality from diarrhoea was high then the environmental characteristics which contributed to the spread of the disease were important in the life chance of an infant. In 1906 more than 50% of infants who died as a result of diarrhoea died before they reached the age of six months. If age were, indeed, an important factor then the implication of this is that for the purpose of this investigation personal characteristics and environmental characteristics were important in the case of infant mortality from diarrhoeal disease.

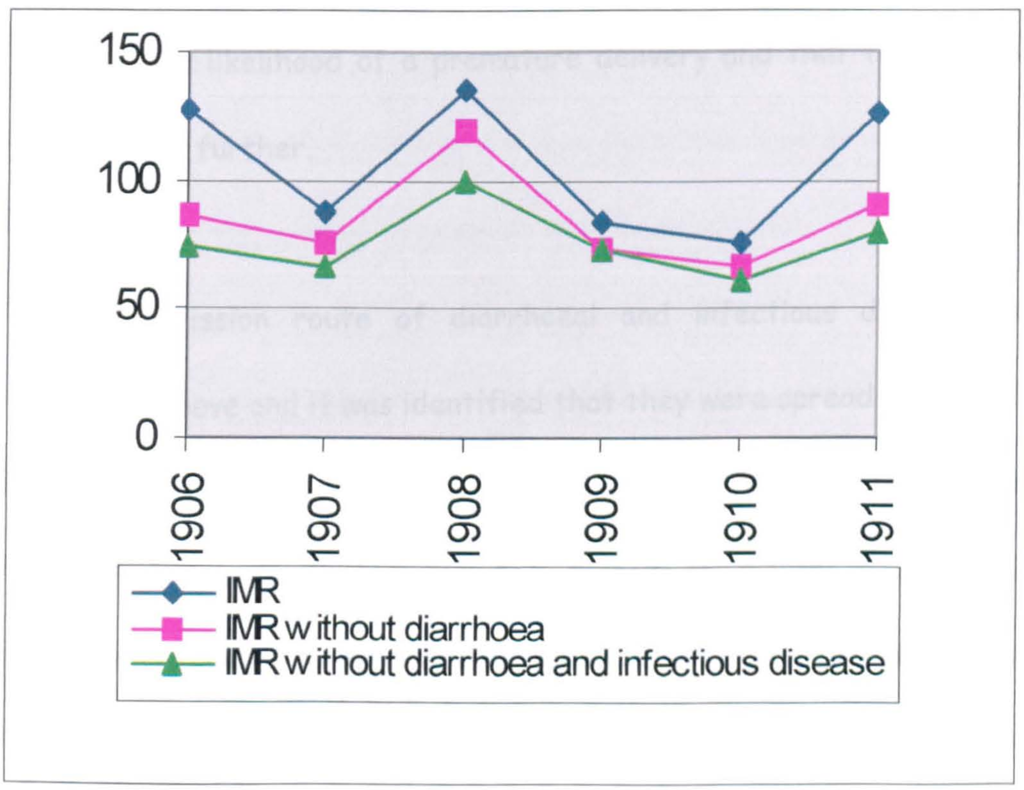
Chart 5.1: IMR and IMR with diarrhoea deaths removed, Cambridge 1876-1911



Source: Medical Officer of Health Annual Reports, Cambridge 1876-1911. (NB Diarrhoea deaths were not recorded in 1901 see below).

The MOH states that the national guidelines on categorisation of cases of diarrhoea were to be modified and until then he awaited an authoritative decision from the Royal College of Physicians therefore the number of cases of diarrhoea are not included in the report for 1901 (MOH report: Appendix Table 1). Chart 5.1 compares the total IMR and the IMR with diarrhoea deaths removed to show a 'background mortality rate'. The 'background mortality rate' plateaued throughout the 1880s and 1890s and started the decline in 1904. In 1905 the IMR fell below 100 for the first time since 1881 and this marked the start of lower levels of mortality, although the IMR rose above 100 again in 1906, 1908 and 1911. When deaths from diarrhoea are removed however, the IMR only rose above 100 in 1908 when, as already identified, there was an excess of infant deaths from both whooping cough and measles.

Chart 5.2: IMR, IMR diarrhoea deaths removed, IMR diarrhoea and infectious disease deaths removed, Cambridge 1906-1911



Source: MOH Annual Reports, Cambridge 1876-1911

Chart 5.2 compares the total IMR, with the IMR minus diarrhoea deaths and the IMR with both diarrhoeal deaths and deaths from infectious disease removed for the period 1906-1911. The chart suggests that diarrhoea contributed to the peaks in the IMR in 1906 and 1911 but not in 1908. In that year it has already been shown that whooping cough and measles contributed to the peak. The effect of wasting diseases on the peak in infant mortality will be discussed below, and it will be shown that the number of infant deaths as a result of premature birth was also high in 1908. It is suggested that there is a potential for maternal infection to increase the likelihood of a premature delivery and that this should be investigated further.

The transmission route of diarrhoeal and infectious diseases were discussed above and it was identified that they were spread as a result of exogenous factors but necessarily the same ones. Although the density of the population contributes to the spread of diarrhoea, Woods and Shelton argue that there are no additional deaths from diarrhoea above a population density of 200 persons per square kilometre. They also suggest that the process that turns a village into a town may result in a higher IMR as a consequence of the increased incidence of diarrhoea (Woods & Shelton, 1997: 55). This could provide an explanation for the high number of infant deaths from diarrhoea in Barnwell, which were repeatedly reported by the Cambridge MOH. In Chapter 3 the rapid development to the east of Cambridge was described and it was stated that the growth in housing in the village of Barnwell soon meant that this became part of Cambridge and the previously healthy living conditions of a village, with access to fresh air no longer existed in crowded conditions of the expanding town. Villagers unused to living in these conditions were more likely to succumb to those diseases which were easily spread when people lived in close proximity. In a village where there was plenty of space disposal of household refuse did not present a problem, whereas the reverse was true in town living. An increase in the number of flies on the refuse led to the spread of infantile diarrhoea.

Williams and Galley used Annual Registration District data to explore these urban/rural differentials and investigated the relationship between different sized conurbations with their rural hinterlands in the period 1850-1910. Cambridge, with its rural hinterland of Chesterton, was one of the areas they selected. Generally the path of infant mortality in the hinterland areas mirrored that in the towns but at a much lower level. There were, however, exceptions. The IMRs for Cambridge, Leicester and Norwich remained high whilst their respective hinterland areas showed a substantial and sustained decline throughout the period 1850-1910. On the basis of their analysis, Williams and Galley suggest that whilst an examination of cause of death and seasonality data could add to our understanding of the urban excess in infant mortality, it would not provide an explanation for why infant mortality eventually declined (Williams & Galley, 1995: 407-420). The seasonality of diarrhoeal diseases is discussed below.

In the case of Cambridge the rapid growth of the town to the east led to Barnwell, which was previously a village on the outskirts of the town, becoming part of the town. This may well have led to an increase in the number of cases of diarrhoea because the village lifestyle was not conducive to town living.

Wasting diseases

The conditions in the third category, wasting diseases, were largely the result of internal, or endogenous, factors. These conditions were not transmitted to others, as were the diseases in the first two categories. Characteristics internal to the infant and the parents led to an infant failing to thrive, premature delivery and congenital conditions. For instance a mother whose nutritional intake was impaired as a result of poverty was more likely to give birth to a smaller baby. Then due to her own weakened condition she may well have been unable to maintain satisfactory breast-feeding.

As stated above the MOH category of 'wasting disease' included premature birth, congenital defects, injury at birth, lack of breast milk, atrophy, debility and marasmus. These conditions were the result of endogenous factors, which affected the infant *in utero*, or around the time of birth. Lack of breast milk, atrophy, debility and marasmus will be considered here as one group; 'failure to thrive'. Wasting diseases made up 38% of all infant deaths in the period 1906-1910 (Table 5.3). The three tables below consider deaths as a result of premature birth, as a result of congenital conditions and from 'failure to thrive'. They are all considered in relation to age and year of death. There is no table for 'birth injury' as in the five year period 1906-1910 there were only three recorded deaths from birth injury, (2% of deaths from wasting disease) one in each of the years 1907, 1909 and 1910. All birth injury deaths occurred in the first week of life.

Table 5.8.1: Infant deaths resulting from a premature birth by age at death, Cambridge 1906-1910

Age in months	1906	1907	1908	1909	1910	Total
Under 1	10	11	18	16	8	63
1	1	2	2	5	3	13
2			1	1		2
3			1			1
Total	11	13	22	22	11	79
No. of births	791	816	791	854	799	4051
IMR for prematurity	14	16	28	26	14	19.5

Source: MOH reports, Cambridge 1906-1910 Appendix Table 5
NB: this table is shorter than the other two because there were no deaths as result of prematurity after the infants reached four months of age.

Deaths from prematurity contributed 51% of all deaths from wasting diseases. The majority (80%) of infant deaths from prematurity occurred in the first week of life. All infant deaths from prematurity occurred before the infant reached the fourth month of life. As stated above the peak in the IMR in 1908 was not solely accounted for by an increase in deaths as a result of infectious diseases. In that year the IMR for prematurity was higher (28) than in the other years in the five year period. Although not shown in Table 5.8.1 in 1911 the IMR for prematurity was 21 (16 deaths 764 births).

Table 5.8.2: Infant deaths resulting from congenital conditions by age at death, Cambridge 1906-1910

Age in months	1906	1907	1908	1909	1910	Total
Under 1	3	2	2	1	2	10
1		1		1		2
2						
3			1			1
4						
5						
6					1	1
7						
8						
9		1		1		2
10						
11						
Total	3	4	3	3	3	16
No. of births	791	816	791	854	799	4051
IMR for congenital conditions	3.8	4.9	3.8	3.5	3.8	3.9

Source: MOH reports, Cambridge 1906-1910 Appendix Table 5

Deaths from congenital conditions accounted for 10% of infant deaths in the wasting diseases category. Table 5.8.2 shows that although the majority of these deaths occurred in the neonatal period deaths also occurred in subsequent months. Infants with congenital conditions which are not a threat to life can survive beyond the neonatal period but their condition makes them more vulnerable and more likely to die from causes linked to this vulnerablility. The mortality rate per 1000 live births for death due to congenital conditions in the five year period 1906-1910 was

3.9. In 1911 there were five deaths due to congenital conditions which gave an IMR of 6.5 deaths per 1000 live births.

Table 5.8.3: Infant deaths resulting from failure to thrive by age at death, Cambridge 1906-1910

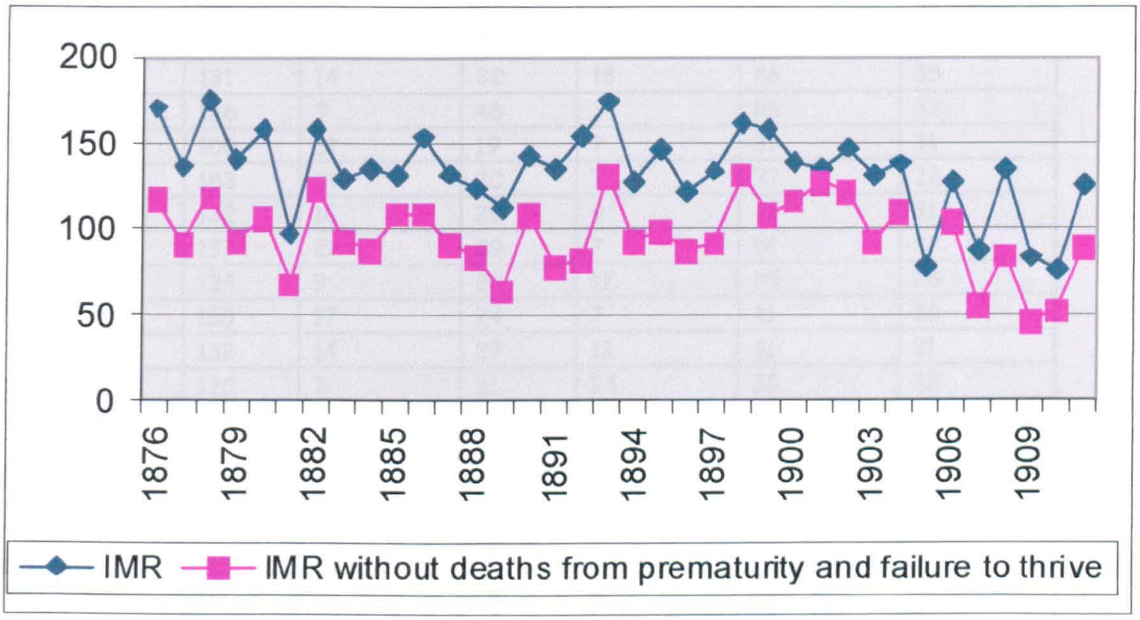
Age in months	1906	1907	1908	1909	1910	Total
Under 1	2	3	7	6	5	23
1	4	5	6	1	1	17
2	2	2	2			6
3						0
4			2	1		3
5		1		1		2
6		2			1	3
7		1		1		2
8			1			1
9					1	1
10						
11						
Total	8	14	18	10	8	58
No. of births	791	816	791	854	799	4051
IMR for failure to thrive	10	17	23	12	10	14

Source: MOH reports, Cambridge 1906-1911 Appendix Table 5

Deaths from 'failure to thrive' accounted for 37% of deaths in the wasting disease category. The majority of these deaths occurred in the first two months of life, 23% in the first four weeks and 17% at one month of age. The IMR in the five years 1906-1910 for death from failure to thrive was 14 deaths per 1000 live births. In 1908 the rate was

23, and thus it seems that in that year infant deaths from all causes was higher than average.

Chart 5.3: IMR & IMR without deaths from prematurity & failure to thrive, Cambridge 1876-1911



Source: Cambridge MOH report, 1876-1911

Chart 5.3 compares the overall IMR with the IMR less deaths from premature birth and failure to thrive. The general trend remained very similar except that in some years the gap between the two was wider, in particular in 1892. In 1892 47% of infant deaths were as a result of either prematurity or 'failure to thrive', the highest amount in any year with the exception of 1908 (Table 7.9).

Table 5.9: A comparison of infant deaths from prematurity with those deaths as a result of 'failure to thrive': Cambridge 1876-1910

YEAR	BIRTH	Total N Deaths	N deaths prematurity	N deaths as a result of failure to thrive	Difference between N deaths from failure to thrive and prematurity	Total deaths from failure to thrive and prematurity	Total deaths from failure to thrive and prematurity As a % of total N deaths
1876	987	165	7	41	34	48	29
1877	1057	141	8	37	29	45	32
1878	1036	181	15	42	27	57	31
1879	932	131	14	32	18	46	35
1880	1051	166	9	46	37	55	33
1881	1026	100	12	19	7	31	31
1882	973	153	13	20	7	33	22
1883	1023	132	16	25	9	41	31
1884	1012	137	22	29	7	51	37
1885	1023	134	9	26	17	35	26
1886	1014	155	17	24	7	41	26
1887	1002	132	14	27	13	41	31
1888	971	120	7	31	24	38	32
1889	1023	115	17	33	16	50	43
1890	946	134	14	19	5	33	25
1891	996	134	21	35	14	56	42
1892	**935**	**144**	**30**	**37**	**7**	**67**	**47**
1893	976	170	17	25	8	42	25
1894	930	119	6	26	20	32	27
1895	972	142	23	23	0	46	32
1896	950	116	16	18	2	34	29
1897	933	125	16	23	7	39	31
1898	884	142	12	13	1	25	18
1899	968	136	13	11	-2	24	18
1900	923	128	14		-14	14	11
1901	794	107	No data	No data	No data		
1902	841	114	11	No data	-11	11	10
1903	835	99	14	No data	-14	14	14
1904	818	113	17		-17	17	15
1905	892	107	13	5	-8	18	12
1906	791	70	11	8	-3	19	27
1907	817	101	13	14	1	27	27
1908	**790**	**72**	**21**	**18**	**-3**	**39**	**54**
1909	853	112	22	10	-12	32	29
1910	853	71	11	8	-3	19	27

Source: MOH reports 1876-1910, Appendix table 1

The contribution of each of the causes of death is shown in Table 7.9 and it can be seen that the number of deaths from prematurity was higher in 1892 than in any other year in the period 1876-1910. The number of deaths from 'failure to thrive' was also high, although not as high as in 1876, 1878 or 1880. This led to a rise in the overall IMR (Table 7.9). Craig found that in 1889, 47% of infant deaths in Cambridge were due to debility and premature births (Craig, 1995: 23). Whereas we found it to be 43%. And the peak year was indeed 1892. Table 7.9 shows that the difference between the number of deaths from 'failure to thrive' and those from prematurity changes over time. From 1876 to 1898 there were more deaths from 'failure to thrive' but from 1899 the number of deaths from prematurity was greatest albeit by a lesser amount. The number of deaths in 1908 was discussed above and it was suggested that maternal health may have contributed to an increase in premature births; the number of deaths from 'failure to thrive' is also higher than in the previous three years. Maternal illness would result in a drop in the amount of breast milk produced. The year 1909 follows a similar pattern but deaths from these diseases do not make up such a high proportion of total deaths. To draw any firm conclusions maternal health must be investigated in relation to infant survival.

It has already been shown in Chart 5.2 that the IMR with deaths from diarrhoea and infectious disease removed shows a steady decline in the six-year period except for 1908. So it seems that an explanation is that in some years a rise in deaths from the three causes, prematurity, failure to thrive and infectious disease coincided and this resulted in a rise in the IMR above the general trend, thus masking an underlying decline.

Tuberculous disease

Almost all cases of tuberculous disease, the fourth category, were acquired through the respiratory route, by breathing in infected droplets from a person with respiratory tuberculosis (Salisbury, Ramsey, Noakes: 391). Overcrowded conditions lacking fresh air contributed to the spread of tuberculosis. Tuberculous diseases were also spread by contact with animals that were susceptible to tuberculosis, such as cows (Salisbury, Ramsey, Noakes: 397). If herds were not tuberculin tested, to ensure they were free from tuberculosis, then the milk produced by those herds may well have been infectious thereby spreading the disease to humans by ingestion of infected milk.

Category 'Other Causes'

Table 5.10: *Causes of infant death included in the MOH category other causes, Cambridge* 1906-1910

Causes	N of deaths	% of total N of deaths in other causes' category
Bronchitis	34	22
Convulsions	14	10
Laryngitis	1	1
Meningitis (not tubercular)	3	2
Pneumonia	52	37
Rickets	1	1
Suffocation or overlaying	10	7
Syphilis	3	2
Unspecified	26	18
Total	141	

Source: MOH reports, Cambridge 1906-1911 Appendix Table 5

The last category 'other causes' included a wide range of diseases therefore it is impossible to generalise about the transmission route of this category. As described above (page 155) this category included a number of specified causes including bronchitis and pneumonia, the category also includes diseases grouped together under the heading unspecified causes, although a cause of death may have been recorded on the death certificate it did not fit into any category therefore the MOH put those deaths into an unspecified cause of death category. The specified diseases are dealt with in more detail below. 'Other causes' made up 34.4% of all deaths under one year of age (Table 5.3). Table 5.4

shows that of those diseases where the MOH specified the cause the most frequently occurring causes were bronchitis and pneumonia. The diseases in the unspecified category accounted for 18% of the total in the category other causes.

Table 5.11: Infant deaths resulting from bronchitis by age at death, Cambridge 1906-1910

Age in months	1906	1907	1908	1909	1910	Total
Under 1			1		1	2
1	1	2	2		3	8
2	2	1				3
3	2		1			3
4						
5						
6	2	1				3
7		2		1	1	4
8			1	1	1	3
9	1		2			3
10						
11				2		2
Total	8	6	7	4	6	31
No. of births	791	816	791	854	799	4051
IMR for bronchitis	10	7	9	5	7	8

Source: MOH reports, Cambridge 1906-1911 Appendix Table 5

The IMR for bronchitis in the period 1906-1911 was 8 deaths per 1000 live births. There was some variation between the years, 1906 experienced the highest number of deaths and 1909 the lowest. Bronchitis in infants is invariably due to viruses, either the respiratory syncytial virus (RSV) or those of the influenza/para influenza group. This is in contrast to the situation with regard to adults, when it is usually the result of an overgrowth of the normal bacterial flora in the lungs (Barnes and Roberton, 1981: 41). Since thirteen of the thirty one deaths from bronchitis occurred in the first three months of life it seems likely that these were the result of infection with RSV resulting in bronchiolitis[1], a serious illness for infants under the age of six months. The infant can become severely dyspnoeic (difficulty breathing) and even in the 1980's 5% of those infants who develop bronchiolitis were reported as developing heart failure as a complication of the disease. The disease occurs in epidemics between January and March (Barnes and Roberton, 1981: 41).

In infants it is clinically difficult to separate bronchiolitis from pneumonia which is the result of staphylococcal bacterial infection. Pneumococcal pneumonia, the result of infection by the pneumococcus bacteria is a cause of disease in older children (Barnes and Roberton, 1981: 43).

[1] Bronchiolitis is a common respiratory infection that affects babies and young children. It occurs when the smallest airways in the lungs, called the bronchioles, become infected and inflamed, leading to a build-up of mucus.

Table 5.12: Infant deaths resulting from pneumonia by age at death, Cambridge 1906-1910

Age in months	1906	1907	1908	1909	1910	Total
Under 1			1	1		2
1	3	1		1	1	6
2	1	3	1		1	6
3		1	2			3
4	2	1				3
5	1					1
6	2				1	3
7	3	1			1	5
8	1	2	1	1	1	6
9	3	4	1		2	10
10	1	1	2			4
11	1			1	1	3
Total	18	14	8	4	8	52
No. of births	791	816	791	854	799	4051
IMR for pneumonia	23	17	10	5	10	13

Source: MOH reports, Cambridge 1906-1911 Appendix Table 5

The IMR for pneumonia was 13 deaths per 1000 live births in the period 1906-191 and again there was a variation in the death rates between the years under investigation (Table 5.12). In 1906 the mortality rate was highest at 23 per 1000 live births and the rate reached 17 in 1907. On the other hand in 1909 the rate was only 5 per 1000 live births. In the five year period deaths from pneumonia occurred at all ages with the greatest number occurring at nine months of age.

In the 'other diseases category there were 14 (10%) cases of convulsions. Convulsions or fits may result from various causes. During the first month of life the most common are birth asphyxia, intracranial bleeding and metabolic disturbances (Barnes and Roberton, 1981: 59). From one to six months of age tuberous sclerosis or serious brain disease are the main causes and from six months infants become susceptible to febrile convulsions; fits provoked by fever. The source of the fever is frequently a viral respiratory tract infection but could be due to meningitis (Barnes and Roberton, 1981: 60). It can be seen that with such a range of conditions presenting the symptom of convulsions, it is hard to decide whether exogenous or endogenous factors contributed to the deaths of these infants. Infections, which can precipitate febrile convulsions, could implicate exogenous factors. Whilst, on the other hand, death from convulsions as a result of congenital conditions or trauma at birth are more likely to occur in the first months of life and can, therefore, be due to personal factors rather than environmental characteristics.

The distribution of deaths from convulsions reflects the use of a symptom as a cause of death (Table 5.12) over the five year period. Cause of death given as convulsions and assigned to the category 'other causes' demonstrates the problems associated with the categorisation of infant deaths. When symptoms are used to categorise cause of death this leads to deaths from a number of causes being grouped together, as if they were one, when in fact they are not. This is problematic when determining factors that predispose to cause of death because they may differ according to the actual diagnosis.

Table 5.13: Infant deaths resulting from convulsions by age at death, Cambridge 1906-1910

Age in months	1906	1907	1908	1909	1910	Total
Under 1	1	2		1		4
1		1	1			2
2			1	1		2
3						
4						
5				1	1	2
6			2			2
7	1					1
8						
9						
10						
11				1		1
Total	2	3	4	4	1	14
No. of births	791	816	791	854	799	4051
IMR for convulsions						3.5

Source: MOH reports, Cambridge 1906-1911 Appendix Table 5

Even more confusingly, 18% of deaths in the 'other causes' category have no precise cause of death assigned to them. The majority of these occurred in the first three months of life. Since these deaths were known to be certified by a medical practitioner (see above) the actual cause of death may well have been known but did not fall into a specific category or the doctor did not know the causes, and chose to say so. Without the actual certificates there is no way to tell.

Seasonal aspects of diarrhoeal and respiratory diseases

Diarrhoeal and respiratory diseases display a seasonal aspect, with diarrhoea more commonly occurring in the summer months and respiratory diseases in the winter. This was borne out in Cambridge between 1875 and 1916 (Craig, 1995: 23). Williams and Galley found that the risk of infant death in towns was higher than that in rural areas in the summer months. In Cambridge it was more than one and half times that of the rural area of Chesterton, which encircled it. In the rest of the year the IMR was one and a quarter times greater in Cambridge (Williams & Galley, 1995: 414-416).

Table 5.14 shows the peak quarters for the IMR over the forty-year period 1871-1910. The IMR peaked in the third quarter in 19 years out of 40. The first quarter was the highest quarter in 15 years, whilst the second quarter only featured twice and the fourth three times. The third and fourth quarters were joint equal in one year. When the IMR was highest in the third quarter, this was usually by a considerable margin.

Table 5.14: Quarter* of the year with the highest infant mortality, Cambridge 1871-1910

Year	Qtr	Year	Qtr	Year	Qtr	Year	Qtr
1871	1	1881	3	1891	3	1901	3
1872	3	1882	1	1892	3	1902	2
1873	3	1883	3	1893	3	1903	1
1874	3	1884	3	1894	4	1904	3
1875	1	1885	3 & 4 equal	1895	3	1905	1
1876	3	1886	3	1896	1	1906	1
1877	2	1887	1	1897	3	1907	1
1878	3	1888	4	1898	3	1908	1
1879	1	1889	3	1899	1	1909	4
1880	3	1890	1	1900	1	1910	1

Source: Registrar-General Quarterly Returns.

* Quarter 1: Jan-March, Quarter 2: April-June, Quarter 3: July-September: Quarter 4: October-December.

Thus the average IMR was 174 in the first quarter, 166 in the second quarter, 215 in the third quarter, and 157 in the fourth quarter. It seems that in the 1900s the dominance of the third quarter lessened: the third quarter was highest in only two years of this decade and did not feature at all after 1904. this has significant implications for the timing of the decline in infant mortality both in Cambridge and nationally. If the fluctuations in infant mortality each year were due to diarrhoeal and respiratory deaths then it would be expected that the peaks would vary accordingly. If the peak was in the third quarter then it might be predicted that diarrhoeal deaths would be high. If the peak were in the first or fourth quarter then it would be expected that deaths from respiratory disease would be high. When this is tested it does not always hold true, at least in the case of Cambridge (see Table 5.15).

Table 5.15: IMR peak quarter, annual diarrhoea and respiratory disease IMR, Cambridge 1876-1910

Year	P	D	R	Year	P	D	R	Year	P	D	R	Year	P	D	R
1876	3	33	37	1886	3	24	27	1896	1	14	27	1906	1	42	33
1877	2	14	28	1887	1	18	21	1897	3	26	12	1907	1	12	24
1878	3	32	30	1888	4	9	29	1898	3	35	34	1908	1	15	19
1879	1	0	39	1889	3	6	18	1899	1	43	15	1909	4	11	9
1880	3	29	18	1890	1	16	24	1900	1	30	12	1910	1	9	16
1881	3	14	12	1891	3	10	27	1901	3	35	14				
1882	1	10	42	1892	3	11	22	1902	2	13	29				
1883	3	17	26	1893	3	50	25	1903	1	13	29				
1884	3	24	17	1894	4	9	17	1904	3	28	18				
1885	P	18	36	1895	3	22	24	1905	1	16	9				

Key: P = peak quarter
D = Diarrhoea IMR
R = Respiratory disease IMR

Source: Registrar-General Quarterly Returns and MOH Reports Cambridge.

A comparison between the quarter where the IMR was highest (peak quarter) and the annual IMR from diarrhoea and respiratory diseases is made in Table 5.15. The first quarter of the year, January - March, has the highest quarterly IMR for the year in fourteen years. In nine of these fourteen years the annual IMR for respiratory disease was higher than that for diarrhoea. The peak was in the third quarter, July-August, on sixteen occasions and on nine of those occasions the IMR for diarrhoea was higher than that for respiratory disease.

It has already been shown that infectious disease is cyclical in nature. Cause of death details in the MOH reports show that when second quarter peaks occurred these were very often due to infectious diseases. The second quarter peak of 1877, for instance, was the result of the deaths of eighteen infants from whooping cough and that in 1902 of seventeen infants from measles. Deaths from infectious disease occurred at other times but it was the contribution of such deaths to second quarter deaths which led to a second quarter peak. It must be remembered that professional families as well as working class families suffered the loss of infants from infectious disease. In 1877 Josiah Chater, a respected Cambridge business man, recorded in his diary that eight of his children were in bed with measles and whooping cough and sadly baby Llewellyn died in May of that year (Porter, 1978: 172-173). [2]

The Vaccination Birth Registers can provide more detailed seasonal and age at death information. It has already been shown that the annual IMR

[2] Josiah Chater came to Cambridge as a young man in the mid nineteenth century. Detailed diaries of his life have been used by Enid Porter to describe Victorian life in Cambridge from the perspective of a young apprentice living and working in the centre of the town through to the time he became a successful businessman.

hides any variation in seasonal rates (Chapter 4) and that age at death varies with cause of death. Table 5.16 shows the number of infant deaths under and over three months for each quarter for the period 1906-1911. Deaths after vaccination are not included.

Table 5.16: Quarterly infant deaths under 30 days of age, Cambridge 1906-1911, from the Vaccination Birth Registers

Quarter	1906	1907	1908	1909	1910	1911
1	24	18	26	17	14	14
2	8	8	19	7	12	15
3	19	12	21	12	12	25
4	10	12	22	13	10	26

Source: Vaccination Registers, Cambridge 1905-1911

It has already been identified that 1906 and 1911 were peak years for infant deaths from diarrhoea and that these deaths occurred at all ages in the first year of life. It is interesting to note that when deaths under 30 days are considered, quarter one had the highest number of deaths in each of the five years 1906-1910 but that quarter four had the highest number in 1911, closely followed by quarter three. The peaks in the IMR between the years 1906 to 1911 can be attributed to the three causes of death categories: infectious disease, respiratory disease and diarrhoea. In 1906 deaths from diarrhoea (Table 5.5), whooping cough (Table 5.3) and pneumonia (Table 5.10) were all high. In 1908 outbreaks of both measles and whooping cough occurred (Table 5.3) leading to deaths from both infections, and it has been shown that deaths from prematurity and 'failure to thrive' also contributed to the peak in 1908.

Conclusion

This chapter set out to answer the question: "Was the decline of the IMR in Cambridge, due to one cause or several"? The MOH compared the causes of infant mortality in two decennial periods the periods, 1895-1904 and 1905-1914, he found that the major causes of infant deaths were diarrhoeal diseases, bronchitis and pneumonia, premature births, debility, measles and whooping cough. We looked at the causes of infant death in the context of the first proposition, and now go on to assess the relative importance of environmental characteristics in relation to those diseases. The need for a cautious approach to causes of infant death statistics were discussed above but they give an indication of the relative importance of those characteristics. Information in the MOH report for the period 1906 to 1910 gives the age of infant death from stated causes when the death occurred. This allowed us to assess the part played by age, a personal characteristic, in relation to cause of death.

In the period 1906-1910 there were 118 neonatal deaths assigned to the category wasting disease, this was 73.3% of the total number of neonatal deaths in that period (Table 5.2). Reid states that "neonatal mortality, occurring in the first month after birth, is dominated by personal characteristics or 'endogenous causes' (Reid, 2001: 213)". Premature births, congenital conditions and those diseases we have grouped together as 'failure to thrive' make up the majority of infant deaths in this category. From Tables 5.8.1, 5.8.2 and 5.8.3 the proportion that each of these causes of death contributes to the total deaths in the 'other causes' category can be calculated. Premature births (63 cases) made up 53% of the deaths, congenital conditions (10) made up 8% and 'failure to thrive (23) made up 19% of the total in that category, leaving 18.8% between the other specified and unspecified causes of death in that category. We can speculate on the factors which lead to a premature birth. We discussed how a premature birth could result from a maternal infection, as could 'failure to thrive' and we concluded that deaths from these causes contributed to a peak in the IMR in 1908, along with deaths from measles and whooping cough. We also know from the MOH reports that premature birth was often given as the cause of death for illegitimate infants. It was found (Chapter 4) that, in Cambridge, illegitimate infants were more likely to die in the neonatal period than their legitimate born peers and they would have contributed to the deaths in this category. Unlike our findings in Cambridge other historians found that the illegitimate infant was not disadvantaged in the neonatal period (Reid, 2001, Wrigley, 1977). As cause of death is not given in the *Vaccination Birth Registers* specific details of the mothers of these Cambridge infants are not available to us but, as will be shown in Chapter 7, the majority of mothers of illegitimate infants gave their occupation as domestic servant, from place of birth it is also known that a number of these births took place in the workhouse. This suggests that many of these women were in poor circumstances which would contribute to a premature delivery. Whether this situation was any different in Cambridge to other similar towns requires further investigation.

Wasting diseases were also the most frequently occurring (38% of total infant deaths) causes of death throughout the first year of life but these were closely followed by deaths categorised as 'other causes' (34.4%), in the 'other causes' category bronchitis and pneumonia made up 59% of the category. Diarrhoeal disease accounted for 17.6% of infant deaths and it can be calculated from Table 5.3 that more than two thirds of these deaths occurred in the first six months of life, with 48.5% of infant deaths from diarrhoea in the first four months of life. Again this is a finding which differs from those of other historians where diarrhoea deaths are found to be more likely to occur after the first four months of life. Since the number of illegitimate births was relatively small then the explanation for the disadvantage experienced by illegitimate neonates does not hold for infants dying from diarrhoea in the first four months of life. Researchers have found that diarrhoeal disease was highest when certain environmental (exogenous) factors and weather conditions prevailed. In Chapter 6 the timing of environmental improvements such as the installation of new sewers, refuse management and the provision of pure water are discussed. These findings are compared with those in this chapter on the incidence of infant mortality from diarrhoea. Diarrhoeal diseases, being spread by the oral faecal route where flies are a vector in the spread of the disease, are further investigated in Chapter 9, as is the role of health visitors in the prevention of the spread of these diseases. Diarrhoea like the respiratory diseases of bronchitis and pneumonia had a seasonal aspect, with diarrhoea more prevalent in the summer months and the respiratory diseases in the winter months.

Although the infectious diseases of measles and whooping cough only made up 7.3% of the deaths in the period 1906-10 these deaths contributed to peaks in infant mortality. For example in 1908 when there were outbreaks of both these diseases. Infants under six months of age were more likely to die from whooping cough than older infants and complication from the disease could lead to death from other causes, particularly respiratory disease, failure to thrive and convulsions as a result of brain damage (Salisbury, Ramsey, Noakes, 2001:227). There are also complications that occur as a result of measles infection and these can lead to death. The effect of diseases caused as a result of complications from infectious disease must be taken into account when investigating the contributory factors to infant mortality e.g. when the incidence of whooping cough was high then death from respiratory disease, failure to thrive and convulsions are likely to be increased. This may well have been the case in 1908.

What does the evidence from the Cambridge cause of death statistics contribute towards an examination of the proposition that environmental characteristics were more important than personal and family characteristics for infant survival? Personal characteristics contributed to causes of death in the category wasting disease (73.3% of neonatal deaths) but 21.1% of deaths in this period were the result of 'other causes' in particular bronchitis and pneumonia where environmental characteristics are implicated. Environmental factors play a part in the spread of both diarrhoeal disease (to be discussed in Chapters 6 and 9) and in infectious diseases. The spread of these diseases is increased by close contact with others and overcrowding is considered in Chapter 7. So from the evidence in this chapter both personal and environmental characteristics played a part in infant death.

Chapter 6

Environmental factors: the role of public agencies

Is there a relationship between the timing of environmental improvements in Cambridge and the decline in the IMR? In this and the following chapter, evidence of the role played by environmental factors in the decline in infant mortality will be discussed. The two chapters complement each other; this one covers Cambridge as a whole during the second half of the nineteenth century and the next examines infant mortality in sub-divisions of the town during the early twentieth century. Local government agencies were responsible for the provision of services designed to improve the environment of a district, but access to the services was largely determined by the type of housing a family lived in, which, in turn, often depended on its income. This chapter, then, considers the role of local government agencies, and the next chapter the role of housing.

Szreter addressed the role of local government agencies in bringing about changes and argued that the reduction in infant mortality was more the result of their activities than it was from individual action (Szreter, 1988). Mooney too examined the part played by the individual and he too argued that the sanitary effect was more important in relation to infant mortality than individual responsibility (Mooney, 1994).

As the population of towns increased so did the problem of unsanitary living conditions. There is a long history of awareness of the link between unsanitary conditions and ill health. Donaldson, Chief Medical Officer of Health, on the occasion of the 125th anniversary of the Royal Society of Health, wrote: "the link between ill health, unsanitary conditions and overcrowding was recognised by those living in the worst conditions" (Donaldson, 2001). As evidence he quoted a letter to *The Times* 3rd July 1849 from John Scott and 55 other residents living in Carrier Street, London, which begged for better living conditions for the poor. There is further evidence, in Glaister's textbook on Public Health that links were made in the Victorian era between the conditions in which people lived and their health (Glaister, 1897). "Sanitary science, not only in its name but also in its development in this country, belongs peculiarly to the Victorian era. Sixty years ago (1837) sanitation, as we now (1897) understand it was conspicuous by its absence" (Glaister, 1897: 96). One hundred years later Wohl (1983) also argued that the growth of sanitary science was a result of urban growth that created vast problems of sewage and water supply.

Although, in the nineteenth century, the link between the conditions in which people lived and ill health had been made, the understanding of how diseases were spread was not fully understood. One theory was dominant, that of miasma. The miasma theory of contaminated air underpinned the work of Edwin Chadwick (1800-1890) who in 1842 published a *Report into the Sanitary Conditions of the Labouring Population of Great Britain.* A 'miasmatic' solution to the problem of Cholera was to separate human and animal waste from food and water so as to reduce the smells produced as the waste decomposed. This proved to be an effective solution, but for different reasons. By the close of the nineteenth century the emergence of the science of bacteriology and germ theory meant that there was a greater understanding of the transmission route of diseases such as diarrhoea. Sir German Sims-Woodhead was awarded the British Medical Association Stewart Prize in 1897 for work in connection with the origin and spread of epidemic disease. He was also joint author of the book *Practical Mycology,* the first systematic book on the new science of bacteriology, which was published in 1898. Sims-Woodhead lived and worked in Cambridge in the early twentieth century and was a member of the executive committee concerned with implementing an infant welfare programme there (see Chapter 8).

Prevention of the spread of disease depended on effective sewage management, the provision of clean water and environmental controls; the subjects of this chapter. The discussion will be centred on three questions

1. Did infant mortality in Cambridge decline when sewage management improved?
2. Was there a relationship between the provision of pure drinking water, improvement in sewage management and IMR?
3. Was there a relationship between environmental controls, improvement in sewage management and IMR?

Did the IMR in Cambridge decline as sewage management improved?

In order to answer this question it is necessary to briefly describe the history of sewage management in Cambridge before going on to compare the timing of sewer improvements with the IMR and in particular trends in the IMR when diarrhoea was given as the cause of death.

The evidence below suggests that the sewage system in Cambridge had a long and tortuous history. It seems that many hours were spent discussing the problem of sewage before anything more than uncoordinated action was taken (Cooper, 1975: 3). Until the end of the nineteenth century all sewage in Cambridge was being discharged untreated from a random collection of open ditches and sewers directly into the River Cam (Cooper, 1975: 1). Kings Ditch, a constant source of complaint by residents, had become an open sewer filled with stagnant sewage, which often overflowed into the streets.[1] As early as 1849 William Ranger was asked to report to the General Board of Health on the sanitary condition of the inhabitants of Cambridge. In relation to sewerage he stated that the first sewers were laid down in 1823 and the last piece in 1848 but that no plans were available, the work having been completed piecemeal.[2] The work was far from complete and the reality was that the process needed to be started all over again. The absence of any plans meant that no one knew what already lay beneath the ground presenting problems for the planning and construction of a general sewerage system for the town. Ranger was aware of a relationship between inadequate sewage removal, epidemic sickness and mortality. He recommended improving the water supply and the sewage disposal system, as well as the footpaths and carriageways.

[1] Kings Ditch was built as a defence fortification in 1215. Having served little for this purpose by the 19th century it was such a nuisance that the 'Cambridge New River' was constructed in an attempt to flush it out (Cooper, 1995)

[2] In his report Ranger (1849: 13) quoted one of the Board of Commissioners, a Mr. Cooper, as repeatedly drawing the Board's attention to the defective drainage particularly in the Barnwell district.

He was the first to suggest that the sewers should no longer be discharged into the River Cam but that instead the discharge should be treated and made available for agricultural purposes as sewerage manure (Ranger, 1849).

No action appears to have taken place following this report since in 1866, fifteen years later, Sir J. W. Bazalgette was approached to provide independent advice.[3] He proposed collecting sewage by means of an intercepting sewer and pumping it to a sewage farm. The state of the river continued to be widely discussed but little real change occurred in the town since the surveyor reported in 1870 that "from minute books it appears that the state of the Cam has for many years engaged the attention of your Board (Board of Health). Various attempts have been made to improve its appearance and sanitary condition, as is evidenced by the dredging works now in progress" (Stephenson, 1870).

As the Board of Health came to no decision on the best sewerage management system, Dr. Anningson, Medical Officer of Health, became increasingly concerned about the sanitary conditions in Cambridge.

[3] Sir Joseph William Bazalgette (1819-1891) , was the Chief Engineer to the London Metropolitan Board of Works who devised the London sewer network.

In his first report (1875) he wrote of the necessity to improve sanitary conditions arguing that the prosperity of a community depended on its inhabitants' capacity to work. He also stated that a special report he had written on the enteric fever outbreak of 1875 was not printed (MOH report, 1875: 16). By 1880 it seems the attention of the Local Government Board had been drawn to the fact that some towns experienced a rise in infant mortality in the third quarter of the year and had written to Dr. Anningson requesting local information on this. He states, somewhat caustically, that his attention had already been drawn to this seasonal rise in infant mortality as early as 1878 and he had reported on it in his quarterly report. The 1880 Annual Report gives a detailed account and interpretation of his investigation into the meteorological and local conditions in Cambridge, which had given rise to an epidemic of summer diarrhoea in the third quarter of the year. He charted day to day rainfall, atmospheric pressure, temperature and humidity against the number of cases of sickness and the number of deaths from diarrhoea in all age groups from July 17 to October 9, 1880. The chart showed that there were two periods of high morbidity and mortality. The first was in the first and second weeks of August and the second in the second week of September. The mortality in the second period exceeded that of the former. Immediately prior to the highest numbers of cases of sickness and death the temperature was between 60 and 70 degrees Fahrenheit (16-22 degrees Celsius) with low humidity and gradually diminishing atmospheric pressure. The first cases of illness were followed by a heavy fall of rain (MOH Report, 1880: 7).

Dr. Anningson also noted the unequal distribution of deaths across Cambridge, which he argued could not be explained by meteorological conditions because the area was too small. In the period July 17 to October 9, the majority of deaths occurred in St. Andrew the Less District (32 deaths) but none of the deaths occurred in the workhouse, which fell within the district. The remaining 3 deaths occurred in St. Giles district of Cambridge, a socially and economically comparable area of the town where the poor lived in overcrowded courts similar to those found in parts of St. Andrew the Less. The only difference between the two districts was that the sewer gradient in St. Giles was very steep whilst that in St. Andrew the Less was slight. A similar pattern of death from diarrhoea was observed in the years 1876 and 1878. In 1880, 60% of the population lived in St Andrew the Less but 79.5% of the deaths from diarrhoea occurred there. Dr. Anningson also noted that cases of sickness and death were concentrated in one half of St. Andrew the Less only. This area lay along a line of sewers where the fall was so slight that sewage was practically stagnant. He argued that gasses produced as a result of fermentation were forced upwards through faulty traps in scullery sinks leading to infection (MOH report, 1880: 7-9). His conclusion must be challenged since it seems from his explanation that he held the miasma theory of transmission to be true. Given present day knowledge that the oral/faecal route transmits gastric infections, a more likely explanation is that soil contamination resulting from a cracked sewer pipe led to spread of the disease. The role of flies in the transmission of gastric infection is discussed below.

By the 1880's the Improvement Commissioners were responsible for sewage management. They, like the Board of Health before them, spent considerable time requesting reports and considering proposals for sewage disposal (MOH reports, 1880-1889). A number of proposals for the construction of sewers were considered but it was not until 1889 that Mr. J. T. Wood, engineer to the Cambridge Improvement Commissioners, was asked to submit a report on the three main schemes that had been proposed. He was considered to be particularly competent to pronounce on the advantages and disadvantages of each scheme since he had knowledge of the local drainage system (MOH report 1889). It seems that even this was not enough since in 1890 James Mansergh, former

President of the Institute of Civil Engineers, was instructed to advise on the respective merits of two schemes put forward, one by J. T. Wood the other by a Mr. Anson (Mansergh, 1890).

In the end, neither proposal was accepted, but Wood was asked to submit a new one. By the time he did so the Borough Council was responsible for dealing with sewage and it adopted Wood's plans in 1891 (Cooper, 1995: 1-3). Negotiations for the proposed sewage farm site at Milton started in 1888 but it did not come into use until 1895 when the sewage scheme for Romsey Town was completed (Andrews, 1995). When the work of replacing the sewage system was completed in 1897 there were 40 miles of soil sewers and 28 miles of surface water sewers serving Cambridge (Julian, 1911: 9).

Infant Mortality Rate and diarrhoea

In the previous chapter the years in which infant mortality from diarrhoea peaked were identified (Table 5.4). This information is used to group the peak years of diarrhoea IMR (Table 6.1).

Table 6.1: Level of the IMR for diarrhoea deaths, by year

IMR* 0 to 10	IMR* Over 10 to 20	IMR* over 20 to 30	IMR* over 30 to 40	IMR* over 40 to 50	IMR* over 50
1879	1877	**1880**	1876	1906	**1893**
1883	1881	1884	**1878**		
1885	1882	1886	**1898**		
1888	1887	1895	**1899**		
1889	1890	1897	1911		
1891	1892	1904			
1894	1896				
1901	1900				
1910	1902				
	1903				
	1905				
	1907				
	1908				
	1909				

* = Number of deaths per 1,000 live births where cause of death is diarrhoea
Years in **bold** all have an overall IMR of 160 deaths per 1000 births or more.

Source: Cambridge MOH reports 1876-1911

It can be seen that although the sewage system was completed in 1897, the IMR from diarrhoea remained high in 1898 and 1899. Despite this Dr. Anningson believed that the completion of the sewage system had resulted in the desired effect of reducing the number of deaths from diarrhoea. His argument for this was that the outbreak of diarrhoea in 1898 was not as deadly as that of 1893. He attributed this to the completion of the sewer installation in Romsey Town in 1895 (MOH report, 1898). Certainly the 1893 outbreak resulted in the highest IMR attributable to diarrhoea in the period 1876-1911; 50.2 per 1,000 live births; the 1898 IMR attributable to diarrhoea was 35.1 per 1,000 live births. Both years experienced a peak in the overall IMR: namely 173 and 161 respectively. Two reasons suggest that it was unlikely that improved sewage management alone provided the explanation for the fall in the IMR from diarrhoea deaths. Firstly, although many of the houses in Romsey Town had water closets, they were not connected to the sewerage system (Cayley, 1906). Secondly, despite this it appeared that Romsey Town was not an area noted for experiencing a high number of cases of diarrhoea. The MOH, who regularly reported on areas of the town where mortality from diarrhoea was a problem, did not include Romsey Town as one of them. Therefore, it seems that Dr. Anningson was wrong in concluding that the completion of the sewerage system in Romsey was solely responsible for the decline in the number of cases of diarrhoea in 1898.

The MOH was not alone in his belief that the completion of the sewage scheme benefited the residents of Cambridge. Dr. Dalton, Chairman of the Public Health Committee, claimed that taken together with other improvements, the sewage scheme had resulted in Cambridge becoming one of the healthiest towns in the country (Dalton, 1908: 6). He argued that the £100,000 cost of the sewage scheme was money well spent. He suggested that as a result of the scheme, the subsoil was drier and that this had led to a decline in cases of Cancer and Phthisis. With present day knowledge it seems unlikely that a drier subsoil provided an explanation for the decline. There is no disputing the fact that a decline in cases of infectious diarrhoea occurred after the completion of the sewage system and that this could possibly be attributed to the improvements. Dr. Dalton also stated that a systematic overhaul of house drains began in 1903-04 (Dalton, 1908: 5). It has already been shown in the previous chapter (Chart 5.1) that peaks in the IMR are only partially explained by a higher incidence than normal of diarrhoea deaths but that if diarrhoea deaths are excluded then lower levels of infant mortality were achieved from 1905 onwards. This suggests that the completion of the sewage management scheme alone does not provide an explanation for the decline in IMR.

Was there a relationship between the timing of the provision of pure drinking water, sewage management improvements and the IMR?

The sewage management scheme was not the only environmental improvement to be carried out in Cambridge in the last quarter of the nineteenth century. The purity of the water supply was improved and this was important because if the water supply was contaminated by sewage an increase in the number of cases of gastro-intestinal diseases would result. The manner in which a water supply can become contaminated was demonstrated in a report of on an outbreak of enteric fever in Caius College, Cambridge in 1874. At the time the cause of the outbreak was identified as contamination of the water in a section of the college by sewer air. There was no evidence that the water for washing purposes was contaminated. The contamination of drinking water occurred because closet water and drinking water shared the same pipes. "When the supply was interrupted the pipes became filled with contaminated sewer air because the water closets were supplied directly from an interposed cistern or service box as recommended by the Cambridge Water Company" (Buchanan, 1874: 7). Buchanan was applying the miasma theory (described earlier) but it seems likely that rather than being contaminated by sewer air, either the closet water became contaminated by sewage, at the same time the drinking water was contaminated, or there was a different route of transmission, for instance lack of hygiene and hand washing by those using the water closet. There is evidence from as early as 1897 that water contaminated by sewage was known to cause diseases in which diarrhoea was a major symptom. Glaister writing in 1897 states that "impurities in water apt to affect health are divisible into two classes, those which have their source in filth or sewage contamination and those due to nature and the amount of mineral constituents. The second class is of lesser importance than the first. From the former may arise dysentery, cholera, enteric fever and diarrhoeal disease" (Glaister, 1897: 96).

Ranger in his report for the Board of Health in 1849 describes in detail four sources of the water supply in Cambridge. These are summarised below.

1. Water collected for domestic use in the town from land springs. The water was collected from wells varying from 15 to 300 feet deep.
2. Water from a source four miles from the town called Nine Wells and brought to the town by Hobson's Conduit.
3. Artesian Wells 100 to 130 feet deep but the quality of this water was not suitable for culinary purposes.
4. A source belonging to Trinity College (Ranger, 1849: 14-15).

Ranger found that in many parts of the town where diseases were common the inhabitants were without an adequate supply of water. He recommended that an abundant supply of pure water on the constant system should be carried to every tenement for the purpose of domestic use (Ranger, 1849: 19-20). The Nine Wells Springs at Great Shelford was found to be of the quality required to comply with the Public Health Act. Although the water supply from this source was satisfactory it was not available to all residents and until the sewage system was improved there was the problem of contamination (Ranger, 1849: 18).

In his report of 1875 Dr. Anningson, Medical Officer of Health, stated that many of the wells supplying water to the town were surface water wells and unsafe for drinking, and that whilst around 2,000 homes were supplied with water from such wells, the remainder had water delivered from the mains supply (MOH, 1875). In the same report he gave details of his investigation into an outbreak of enteric fever in the Newtown district of Cambridge. It is apparent from the report that the spread of the disease was not understood. Dr. Anningson reported that the source of the earliest cases in the outbreak in Cambridge was thought to be pump water, but on investigation this proved to be of a satisfactory quality. The pump water was liable to contamination from a dripping pipe that supplied closet water. The water intended for closet use may well not have been of the quality necessary for drinking water and therefore could have been the source of contamination. Dr. Anningson went on to search for an explanation for the Newtown cases, which it seems he believed were linked to each other although he could not identify that link. He writes that a man from Bury St. Edmunds lodged in a public house in the Newtown district for two weeks and then moved to another part of Cambridge where he became ill and was subsequently admitted to hospital with enteric fever. He stated that "almost co-incidentally with the case a member of the family with whom he lodged fell ill of the same fever, and then two or three others of the same family in quick succession." (MOH report, 1875: 11) Others in the same district fell ill but Dr. Anningson wrote that "(I am) unable to satisfy myself of the existence of any special circumstances for the cause of the outbreak" (MOH report, 1875: 11). It seems likely that the man from Bury St. Edmunds had infected the family members before he moved and that because of the lack of knowledge of germ theory and the incubation period of enteric fever at the time Dr. Anningson was unable to make this link.

The MOH states in his report of 1902 that, "the town is almost exclusively supplied by the Cambridge University and Town Waterworks Company" (MOH report, 1902: 27). There were still a few houses where drinking water was obtained from wells, but this practice was gradually being discontinued (MOH report, 1902: 27)

The Company were vigilant in maintain a pure supply of water and following an outbreak of enteric fever at Fulbourn Asylum in 1905 they tested the water and found that this was not the cause of the outbreak. Despite this it raised the level of concern and in 1908 an inquiry was made into the possibility of contamination of a water source adjacent to the Asylum. Dr. Theodore Thomson and Mr. P. M. Crosthwaite investigated the purity of the water supply. They found that the disposal of the Asylum sewage did not involve any risk of pollution of the Company's water supply. (Thomson and Crosthwaite, 1908: 10). Although in the process of the investigation they found no evidence of pollution from the Asylum the leaky sewer pipes and cesspits in the villages of Fulbourn and Cherryhinton did present a danger. To this end it was recommended, to the Local Government Board, that the water supply from the Lower Chalk area should be abandoned because of the risk of contamination (Thomson and Crosthwaite, 1908: 11).

Professor Sims Woodhead also presented evidence to the inquiry. Over the preceding nine years, he had carried out regular bacteriological examination of the tap water in Cambridge. He found that following repairs to the Company's mains and pumping station plant there was an increase in the presence of *bacillus coli communis* (Thomson and

Crosthwaite, 1908: 7). The charts produced in the course of the investigation to identify any relationship between rainfall and bacterial count found that the bacterial count increased a short time after a heavy rainfall. It was concluded that this was suggestive of a causative relationship but that it was not the only factor (Thomson and Crosthwaite, 1908: 8). In 1880 the MOH had shown a relationship between heavy rainfall after a hot spell and an increase in the number of cases of infantile diarrhoea (see above).

The term enteric fever refers to either typhoid fever or enteritis. Enteritis is inflammation of the intestine; acute enteritis is most commonly due to either a bacterial infection or eating unsuitable foods, infected food or food poisoning. Given that the report prepared by Dr. Thomson and Mr. Crosthwaite described the presence of *Bacillus Coli Communis* it seems likely that this reference was to infective enteritis, another name for epidemic diarrhoea or summer diarrhoea. There was no evidence to implicate the mains water supply with outbreaks of enteric fever although there was evidence of a raised bacterial count under certain climatic conditions (Thomson and Crosthwaite, 1908: 8). A table in the report showed the death rate from enteric fever in all age groups in Cambridge and compared this with that for England and Wales for the period 1889-1907. It shows that the death rate from enteric fever in Cambridge, during this time, only exceeded that for England and Wales on six occasions. Namely 1891, 1892, 1893, 1896, 1897 and 1905 (Thomson and Crosthwaite, 1908: 8). During the period 1889 to 1907 the IMR deaths from diarrhoea per 1,000 live births rose above 30 per 1,000 on four occasions: 1893, 1898, 1899 and 1900 (Table 5.4).

Table 6.2: A comparison of IMR from diarrhoea with enteric fever death rate, at all ages in the years when the IMR from diarrhoea was above 30 and those in which the death rate from enteric fever in Cambridge was higher than that for England and Wales

Year	Enteric fever death-rate per 1,000 living Cambridge	Enteric fever death-rate per 1,000 living England and Wales	Infant mortality rate deaths from diarrhoea per 1,000 births in Cambridge
1891	0.32	0.17	10
1892	0.21	0.14	11
1893	0.26	0.23	50
1896	0.18	0.17	14
1897	0.21	0.16	26
1898	0.18	0.18	35
1899	0.02	0.20	43
1905	0.10	0.08	16
1906	0.02	Not recorded	42

Source: MOH reports for Cambridge 1889-1907 and Report to the Local Government Board Dr. Theodore Thomson and Mr. P.M. Crosthwaite, HMSO 1908: 8.

Table 6.2 shows that in only one of these four years, 1893, was the death rate for enteric fever in Cambridge in excess of that for England and Wales. So it seems that when deaths from enteric fever, in all age groups, were high then infant deaths from diarrhoea were not high except in 1893. This leads us to conclude that the factors implicated in the transmission route for diarrhoeal diseases in infants were not necessarily the same as that for the adult population.

Thomson and Crosthwaite commenting on the years when deaths from enteric fever were high stated that "there is no evidence that these exceptional circumstances had a relationship with the public water supply" (Thomson T.Crosthwaite, P. M. 1908:8)

Was there a relationship between the introduction of environmental controls, changes in sanitation and the IMR?

The timing of the completion of the sewage management scheme in Cambridge, 1897, and the provision of pure water in 1902, if not earlier, has been identified but neither appears to have had an immediate impact on levels of the IMR. However, there is a further link in the transmission of infection: the common housefly. The numbers of flies increase when there is a suitable breeding ground and a temperature that enables the eggs to pass through their life cycle to become mature houseflies. Rotting organic material, animal and human excrement provide such a breeding ground, not only for the flies but also for the bacteria and viruses that cause gastro-intestinal infectious diseases. A study in

Preston showed that horse manure and flies played a part in the cycle of the transmission of infant diarrhoea by carrying disease to food and milk ingested by humans (Morgan, 2002). Consequently as systems were put into place to improve sewage management, water supply and the removal of refuse, and as mothers were educated about the hazards of a contaminated milk supply and how to prevent contamination, it would be expected that the incidence of food and water-borne diarrhoeal disease would fall particularly amongst infants. [4]

In order to minimise the spread of disease by the fly vector route, household refuse must be removed and trade waste dealt with effectively. If we consider the MOH reports from 1875, 1885 and 1895, it is possible to observe the necessary systems being put in place, although hazards always remained. In 1875 there was no organised system of removing household refuse (MOH report, 1875). At this time the railway came to Cambridge, stimulating new businesses such as brick and tile works, cement works, flour milling, sausage making and brewing. Each of these trades brought their own environmental problems. Dr. Anningson also mentioned candle making, rag sorting and bone crushing as

[4] See chapter 9 where the evidence is given of the role played by health visitors in the educating of mothers. In addition milk banks providing milk from uncontaminated sources and in sterilised bottles were opened in Cambridge in 1910.

offensive trades and made recommendations for a less offensive method of preparing skins for sausage making (MOH report, 1875: 15). The 34 unregistered slaughterhouses gave him the greatest cause for concern as from them blood went into the surface drains rather than being collected for disposal. Nor were walls in slaughter houses adequately lime washed (MOH report, 1875). Dr. Anningson regularly reported on action taken against offensive trades, factories and workshops. An indication of the conditions and evidence that powers existed to control the nuisance can be gleaned from the cautions issued by the MOH in 1885. In three instances sheep were being slaughtered on unlicensed premises. A duck and fowl butcher's premises and a sugar refinery were both removed as being too close to dwelling houses. Dr. Anningson reported that the trades of bone boiling and fat rendering had proved less troublesome in previous years (MOH report, 1875, 16-17). Not all problems had been resolved, despite notices being served on some "refuse" yards; Dr. Anningson stated that the likelihood was that the trouble would reoccur (MOH, 1895: 16).

It seems that by 1902 Dr. Anningson had set in place environmental controls that would reduce the spread of disease by the common housefly. There was a regular service of house to house scavenging and the material was carried to the refuse destructor at the sewage pumping station (MOH report, 1902: 27). House refuse was collected from the back of premises provided the refuse container was placed within 50feet. of a highway and that the container could be cleaned easily (COS, 1904: 103). The householder was responsible for keeping the backyard or courtyard free from rubbish and properly drained and the Sanitary Authority could serve notice on a householder who kept a filthy house (COS, 1904: 104). Compliance with the regulations by trades' people and householders was, however, necessary for environmental controls to be fully effective in breaking the cycle of the spread of disease. In the case of household refuse even when the householder fully complied with the regulations there was a period of time before the refuse was collected when flies had access to rotting organic material in which the germs could survive and multiply. In this case the only prevention of the spread of disease lay with individuals improving standards of hygiene both in food preparation and personal care.

Conclusion

The question posed at the beginning of this chapter was, 'Is there a relationship between the timing of environmental improvements in Cambridge and the decline in the IMR?' The major environmental improvement in Cambridge in the nineteenth century was the sewerage system, which was not started until 1895. It was funded by the Corporation of the Borough and cost in excess of £100,000 (Dalton, 1908: 2). Dr. Dalton, Chair of the Public Health Committee, in response to sceptics who considered the expenditure of doubtful value, argued that as a result of sanitary activity the town was a healthier place. "How much of the increased good health was due to the sewerage scheme of 1895, and how much was due to other forms of sanitary activity was (he considered) debatable" (Dalton, 1908: 15). If poor sewage management was responsible for the high number of cases of infantile diarrhoea then a decline in infant mortality should result from improvements in sanitation. What of infant mortality in general and infant mortality from diarrhoea in particular following the completion of the sewerage system? Chart 4.1 showed a gentle decline in mortality until the 1890's when the IMR rose. It was not until after 1904 that a secular decline in the IMR was established. Even then it rose in the years 1906, 1908 and 1911. In the previous chapter it was shown that the rise in the IMR in 1908 was due to an increase in the number of cases of whooping cough and measles. Chart 5.1 compared the IMR and the rate with diarrhoea deaths removed, it showed that 1904, 1906 and 1911 were 'diarrhoea years'. Other authors confirmed that nationally infant deaths from diarrhoea were high in the years 1904, 1906 and 1911 (Pooler, 1918: 4, WWW, 1988: 364, WWW, 1989: 130). So it must be concluded that even after a new sewerage scheme had been installed in Cambridge there were still outbreaks of diarrhoea. Animal manure would still have been prevalent in the early years of the twentieth century due to horse traffic contributing to the spread of disease when flies landed on the manure (Morgan, 2001). Table 6.1 (above) gives details of infant death from diarrhoea over the period 1876-1911. There were five years in which the IMR was over 160 and in four of those years, 1878, 1898, 1899 and 1893, the IMR for diarrhoea was over 40 deaths per 1,000 live births. In the fifth year, 1880, the IMR from diarrhoea was over 30 deaths per 1,000 live births. Chart 5.1 shows that when the IMR was 150 or above (10 occasions) on seven occasions this was due to an increase in deaths from diarrhoea. So it seems that diarrhoea deaths were responsible for some but not all rises in the IMR both before and after the installation of a new sewerage system in Cambridge. Dr. Anningson, Cambridge Medical Officer of Health, brought forward two pieces of evidence in support of the hypothesis that the new sewerage system reduced the number of deaths from diarrhoea. Firstly, he showed that infant deaths attributable to diarrhoea were not evenly spread across the town, a factor he believed to be caused by a faulty sewer line. Second, after a new sewage removal system was put in place in 1897, he argued that deaths from diarrhoea fell. Dr. Dalton argued that the death rate in general at all ages had fallen since the completion of the sewerage scheme (Dalton, 1908: 5). Certainly diarrhoea deaths reached a peak in 1893, which was not matched in the period 1904-1911. On the other hand levels did not fall dramatically suggesting that other factors were at work.

Sewage management cannot be considered in isolation, since other environmental factors are implicated in the transmission of bacteria and viruses that lead to cases of infectious diarrhoea, namely the provision of clean water and environmental controls. In 1849 an adequate supply of clean water was not available to all (Ranger, 1849: 19:20). By 1908 bacterial contamination was still present in the public water supply although Thomson and Crosthwaite found that only in exceptional circumstances did it have a relationship to the presence of enteric fever (Thomson, T. Crosthwaite, P.M, 1908: 8). Environmental controls were in place by 1904 to break the cycle of the spread of disease by flies. Compliance with the regulations was necessary for the controls to be effective. Serious outbreaks of diarrhoea occurred even after a supply of relatively clean water and an efficient sewage disposal system were in place. It is not surprising, then, that the long-term decline in infant mortality in Cambridge did not begin until after 1905. Chart 5.1 shows a gentle decline in the general IMR from 1896, followed by a plunge in the IMR in 1905 only for it to 'bounce' back up to 1902-3 levels in 1906, 1908 and 1911. The IMR without diarrhoea does not 'bounce' back nearly as much, except in 1908 when it is the result of an increase in deaths due to infectious diseases. So it seems that the date at which 'low levels' of IMR without diarrhoea was first achieved was 1905. Attention will now be directed at improved personal hygiene and the storage and preparation of food - especially of milk - together with the role of the health visitor in bringing these about (Chapter 9). First, though the role of housing (Chapter 7) and philanthropic activities (Chapter 8) in determining the level if the IMR will be considered.

Chapter 7: Housing

Introduction

In this chapter the state of housing in Cambridge in the early twentieth century is investigated and answers to the following research questions sought:-

Where did the poor live and what was the condition of their housing in early 20th century Cambridge?

Is there a relationship between where an infant lived and the risk of its dying during infancy?

Is there a positive relationship between a high IMR and a low rateable value of housing?

Is there a relationship between the IMR, parental occupation and the rateable value of housing?

Nineteenth and early twentieth century commentators on public health recognised the influence a poor state of housing could have on the health of infants.[1] Also historians have shown that the immediate surroundings in which people lived appear to have been much more important than their

[1]Ashby stated that "the housing of the poor had a direct bearing on infant mortality" (Ashby, 1915: 47). Even earlier Glaister recognised the relationship between space and light to the health of infants, which he argued was second only to feeding (Glaister, 1897).

social class in determining infant and child mortality (Garrett, Reid, Schurer and Szreter 2001)[2]. Present day data shows that geographical inequalities in health have persisted in England into the twenty-first century. Inequalities exist nationally between north and south and locally within communities. (Acheson, 1998). The data in this chapter are drawn from Cayley's 1902 investigation into the state of housing of the poor in Cambridge (see Chapters 2 & 3) and the Vaccination Birth Registers. The outcome is an investigation into mortality up to three months of age at street level.

There were areas of affluence and areas of poverty in nineteenth century Cambridge. As we have seen (Chapter 3), the Barnwell Enclosure Act of 1807 released a considerable amount of land for building. Speculative local builders quickly erected terraced housing for the growing number of working class families. The first development was in the Newmarket Road and Fitzroy Street areas of Barnwell, followed by the first new streets being built in the horticultural district known as the Garden of Eden.

[2] Garrett *et al* (2001) used individual census returns of 1891, 1901 and 1911 (having been given permission to access the 1901 and 1911 census material ahead of the scheduled release date). They were thus able to examine the decline in infant mortality and marital fertility around the turn of the twentieth century.

The rapid expansion in housing not only resulted in environmental problems for families living in cramped conditions in the alleys and courtyards of the town, but, as Cambridge grew, those previously living in what had been essentially a rural environment found themselves living on the edge of an expanding town. The growth of the most notorious area, Barnwell, spread along what were previously country roads. It seems that the rapid growth in housing occurred with a lack of foresight for the environmental problems that would arise. Jebb stated that there was an absence of any civic or philanthropic concern over the social conditions as the town grew in a very haphazard way that "could not fail to have a deleterious result" (Jebb, 1904: 14).

Given this it was to be expected that a geographic inequality in the distribution of unsuitable housing would be apparent in early twentieth century Cambridge. If lack of access to pure water and sewage disposal, together with unsuitable housing, were factors in maintaining a high infant mortality rate then it would be expected that low rents, and low rateable value housing would correlate strongly with high infant mortality. On the other hand high rents, and high rateable value housing would correlate with low infant mortality. Since where a family lived was largely determined by income and family size, it would be expected that families living in high rent, high rateable value properties would have a head of the household in a well paid occupation. It would follow that infants born into these families would be less likely to die before reaching their first birthday than their peers in low rent accommodation. [3]

Where did the poor live and how were they housed in early 20th century Cambridge?

As discussed in previous chapters Cayley and his team of investigators used a detailed questionnaire to determine the state of each house in Cambridge with a rent of less than 6/- a week. His findings can be used to determine where the poor of Cambridge lived and what their housing conditions were. In total the team visited 2,226 houses (25.4% of the houses in the town), a process that took in excess of one year to complete. Cayley examined the findings in the light of accepted standards for overcrowding, defective repair, height of rooms, supply of tap water, water closets and the presence of a yard or garden. At this time the Registrar-General's standard test for overcrowding was more than two people per room and a room height of less than eight feet. When the

[3] "Housing always reflected the changing economic position of the household. Rent was a major item in the budget of the poor, even though the standard of their housing was low. It was significant, therefore, that it could be varied, both by changing quarters and by reorganising the household." (Davin, 1996: 29)

results of the investigation were presented, the committee came to the unanimous conclusion that rather than pressing for the adoption of Part II of the Housing Act to bring about the improvements they would press private landlords and the corporation to deal with the identified deficiencies (Cayley, 1904).

Table 7.1:Percentage of the population living in low rent property, Cambridge 1902-3.

1. Parish	2. No. of houses reported on by Cayley	3. Population reported on by Cayley	4. Total Population of part of town	5. % Cayley's population	6. % of total population of town
St. Andrew the Less	530	2152	8028	24	21
St. Matthew	583	2409	6279	27	16.5
St. Barnabas & St. Philip	459	2008	8912	22	23
Holy Trinity	60	232	1365	3	4
St. Paul	260	1035	4744	11	12.5
Small central parishes	126	416	6261	5	16
St. Giles	208	722	2791	8	7
Total	2,226	8,974	38,380	100	100

Source: Cayley, H. (1904), The *Housing of Cambridge*. London, Rivingtons

In Table 7.1 Caley's data has been used to determine the distribution of the poor throughout Cambridge. It is possible to determine the proportion of poor families in each parish because Cayley recorded not only the number of houses visited but also the number of occupants living within those houses. Knowing this he could compare the number of people he reported on with the total number of people living in the parish reported in the 1901 census. The census data refers to all the population not just families with infants. Cayley reported on the parishes of St. Barnabas and St. Philip individually but as the census did not distinguish between the two they are combined in Table 7.1. Column 5, shows the distribution of the population visited by Cayley's team; people living in houses with a rent of less than six shillings per week. Of the 8,974 people living in the 2,226 houses visited, 27% were in the parish of St. Matthew whereas only 16.5% (column 6) of the total population of Cambridge lived in that parish. The number of low rent houses reported on by Cayley in the parish of St. Matthew was 583, and since there were 1,284 (1901 Census, Table 9) inhabited houses in that parish this meant that Cayley reported on 45.4% of the houses.

However, 16% (column 6) of the population of Cambridge lived in the small central parishes but only 5% (column 5) of the poor (i.e. those living in houses where the rent was less than 6s. a week) lived there. Therefore, when compared with the parish of St. Matthew, Cayley and his team investigated a much smaller proportion of the total number of inhabited houses in the smaller central parishes, 126 houses out of a total of 875, thus in the smaller central parishes only 14.4% of the houses had a rent of less than 6/- a week.

In the other parishes the poor seem to have been distributed roughly in line with the general population, although in Barnwell (St. Andrew the Less parish) there were more poor people than the size of its population might have led one to expect.

What was the state of the housing of the poor in each parish?

As we have seen, Cayley reported on housing that was rented for less than six shillings per week. The total number of houses reported on differed between his tables, although only slightly, because not all the forms were fully completed, From his data it is possible to rank each parish according to various features of the housing stock with a rent of less than 6/- a week. This is done in Table 7.2 on a scale of one to eight; with 1 being the parish with the most houses of the poor reaching an adequate standard and eight being that with the smallest number doing so. In the case of bedroom overcrowding Cayley produced seven tables ranging from over two persons per bedroom to over six persons. For the purpose of ranking in Table 7.2 the data from Cayley's table showing over three persons to each bedroom was used (Cayley, 1904: 8).

Table 7.2: Ranking by the state of housing rented for less than six shillings per week in eight parishes, Cambridge 1902-3, when 1 is ranked best and 8 worst.

	St. Andrew the Less	St. Matthew	St. Barnabas	St. Philip	Holy Trinity	St. Paul	Small central parishes	St. Giles
Overcrowding	5	3	1	2	7	4	6	8
Bedroom overcrowding	4	6	1	2	5	7	3	8
Defective repair	6	2	1	3	7	8	4	5
Defective height	6	3	1	2	8	7	4	5
Shared taps	5	4	1	2	7	6	3	8
No water closet	6	4	1	1	1	5	7	8
Yard not sufficient	5	2	3	1	7	4	8	6
No yard	5	2	3	1	6	4	8	7
No. of houses	530	583	75	384	60	260	126	208
Average rank	5.25	3.25	1.5	1.75	6	5.63	5.38	6.88
Ranking of the averages	4	3	1	2	7	6	5	8

Source: Table compiled using data from Cayley, H. (1904), *The Housing of Cambridge*. London, Rivingtons: 11-15, (see Appendix 3 for original data) [4]

[4] The Registrar General's test for overcrowding was used, that is people living more than two to a room (Cayley, 1904: 6). Bad structural repair was defined as, houses "in which the roofs, walls, or floors, were not strong enough, in an unsound condition, or seriously affected by damp, - and those in which one or more of the rooms used for spending the day or night in were too low i.e. less than eight feet high" (Cayley, 1904: 11). Cayley stated that there was a difference of opinion as to what standards should be applied to the provision of water, i.e. "whether the tap should be brought inside every house, or whether a bath should be supplied." He reported on the number of taps to the number of houses (Cayley, 1904: 12). In the case of water closets a similar reporting framework was used: the number of water closets to the number of houses sharing them (1904:13). "The visitors were instructed to take the by-laws now in force as a standard of 'sufficient' size for a yard or garden i.e. to record anything less than 150sq. feet in area, or less than 10 feet deep for the whole frontage of the house" (Cayley, 1904: 15).

Table 7.2 shows that the parish of St. Barnabas ranked 1st on 6 of the 8 characteristics; the parish of St. Philip never ranked less than 3rd, while St. Giles ranked worst on 4 and was never ranked higher than 5th. If the findings in Tables 7.1 and 7.2 are compared it can be seen that although Holy Trinity had one of the lowest percentages of the population covered by Cayley (only 3% of the town's poor lived in this parish) it had the second worst housing score. St. Matthew, with a very high proportion of poor, came out 3rd in terms of housing conditions overall.

One must guard against being carried away by the apparent conclusion conveyed by the rankings in Table 7.2. For instance, on the face of it, one might assume that the average rankings should be reflected in the level of infant mortality. However an average ranking might quite easily hide a poor situation on just one of the variables. For instance, the parish of St. Matthew ranked 3rd overall, but on bedroom overcrowding, it ranked 6th. As bedroom overcrowding might well have been a critical factor in the spread of airborne diseases, this could well have over-ridden that relatively favourable 3rd ranking overall.

Cayley compared his results with similar investigations in Oxford and York and his findings are shown in Table 7.3. The population living in low rent housing in Cambridge were more likely to share a tap than families living in Oxford or York, but less likely to share a water closet with more than one other family.

Table 7.3: The percentage of low rent housing falling below the recommended standard for state of housing in the early twentieth century, a comparison between Cambridge, Oxford & York

	Cambridge	Oxford	York
Defective repair	15%	15.9%	Not given
Defective height	12.6%	9.3%	Not given
Shared taps	36.2%	22.3%	17.6%
Sharing water closet	4.4%	13.9%	15.4%
No yard	6.2%	Not given	12%
Average rent for 3 rooms	2/11	3/5	3/6

Source: Table compiled using data from Cayley, H. (1904), *The Housing of Cambridge.* London, Rivingtons:11-15, 17.

It seems that within four years of Cayley's report being published action had been taken and housing conditions improved. In her 1908 report Jebb stated that the improvement in the state of housing was "one of the most encouraging advances, which has taken place in Cambridge". She goes on to provide evidence of this improvement e.g. one tap was by then the minimum for two houses and that wherever there had been no flushing cistern for a water closet this had been put in. Additionally houses could be condemned under the Housing of Working Classes Act and were then either made habitable or pulled down (Jebb, 1908: 272r-272s). In contrast to these advances, and despite plans for new housing the MOH stated in his report that there was a lack of low rent housing for the poorer classes. "The houses being built are generally at rentals of 5/6 or 6/- per week or over and they do not therefore meet the needs of a fairly large class in Cambridge who cannot pay that amount" (MOH Report, 1910:44). So it seems that although the condition of housing for the poor improved following Cayley's investigation the availability of low rent housing did not, a situation that could lead to increased overcrowding as families shared the available low rent housing.

So far, this investigation has shown where the poor lived and the state of housing in which they lived, ranked by parish. But the findings relate to the population of Cambridge as a whole and not exclusively to those families with infants.

Table 7.4: Number of births in each parish, Cambridge 1905

1. Parish	2. 1905 Births	3. % distribution of births
St. Giles	60	7
Central	47	5
Holy Trinity	19	2
St. Andrew the Less	207	24
St. Matthew	241	28
St. Paul	86	10
St. Barnabas & St. Philip	212	24
All Cambridge	872	100

Source: Borough of Cambridge Vaccination Registers 1905 - 1906 *G/C/x* vols. 2 to 4 inc.
All located at Cambridge Records Office, Shire Hall, Cambridge.

Table 7.4 shows the number of births in each parish in 1905. Column 3 of this table shows that 28% of the infants were born in the parish of St. Matthew, and that three quarters of births occurred in the parishes of St. Matthew, St. Andrew the Less, St. Barnabas & St. Philip. These parishes together with that of St. Paul made up the sub-registration district of St. Andrew the Less. The remaining parishes, in which 14% of births occurred made up the sub-registration district of St. Andrew the Great.

The Cambridge MOH reports give the IMRs by sub-registration district but not by parish. The number of births and deaths in each sub-registration district were shown in Table 4.2 (Chapter 4) for the period 1900-1910. The table also shows that over five times as many infants were born in the St. Andrew the Less sub-registration district (7806) as in the St. Andrew the Great sub-registration district (1423). The result is that the IMR for St. Andrew the Great district is based on around 100 to 150 births each year whereas that for St. Andrew the Less is based on around 700 births each year. Chance occurrences were, therefore, more likely to affect the IMR in the former sub-registration district than in the latter. In fact, Table 4.4 shows that the IMR for St. Andrew the Less was higher than that for St. Andrew the Great on four occasions in the eleven year period. The IMR for St. Andrew the Great was higher than that for St. Andrew the Less on four occasions and in the remaining three years the IMR was similar in both districts. If the IMR is calculated for the whole of the eleven year period then the IMR for each sub-district is almost the same: 111 per 1000 live births for St. Andrew the Less and 110 per 1000 live births in St. Andrew the Great. On this evidence it must be concluded that differences in IMR observed on individual years at sub-registration district level were balanced out over time.

The Vaccination Birth Register data will be used to explore the relationship between infant mortality at parish level with Cayley's findings on the housing conditions of the poor. The limitations of this data were discussed in Chapter 2 and as infants were vaccinated in their own homes on average around three months of age the q(90 days) measure gives the most accurate picture of infant mortality at least in those first three months (see discussion of this measure in Chapter 2).

The q(90days) mortality measure for the parishes in the St. Andrew the Less sub-registration district are compared with the ranking of those parishes by state of housing. The parishes in the St. Andrew the Less sub-registration district have been chosen because as discussed above only 14% of births occurred in the St. Andrew the Great sub-registration district, whilst 86% of infants were born in the St. Andrew the Less district. It should be noted that the workhouse fell within the parish of St. Matthew and both the births and deaths at the workhouse (81a Mill Road) have been excluded when calculating this measure. Furthermore 28 births could not be allocated to a parish. Although it would be preferable to calculate the q(90 days) measure for individual years the small number of births in each parish precludes this, so the measure has been calculated for the whole of the period 1905-1911. The results appear in Table 7.5.

Table 7.5: St. Andrew the Less Registration district 1905-11: q(90day) infant mortality measure by parish and ranking of state of housing of the poor

Parish	No. of births	q(90days)	Rank by state of housing
St. Philip (Romsey)	1265	0.0397	2
St. Paul	451	0.0408	6
St. Barnabas	239	0.0472	1
St. Matthew	1475	0.0546	3
St. Andrew the Less parish (Barnwell)	1336	0.0706	4
St. Andrew the Great (registration district)	831	0.0575	5,7,8.
St. Andrew the Less (registration district)	4857	0.0531	

Source: Cambridge Borough Vaccination Registers
1905 - 1911 G/C/x vols. 2 to 15 inc.
All located at Cambridge Records Office, Shire Hall, Cambridge.

The parishes in Table 7.5 are those that make up St. Andrew the Less sub-registration district therefore there is no rank 5 (Small Central parishes) in the table, neither are rank 7 (Holy Trinity) or rank 8 (St. Giles) included. The small number of births in each parish, all in the St. Andrew the Great sub-registration district, could result in even one death giving a false picture of the relationship between ranking of the state of housing and infant mortality as measured by the *q*(90day) measure. Therefore the *q*(90 days) measure for St. Andrew the Great sub-registration district is included for comparative purposes, as is that for St. Andrew the Less sub-registration district.

If the state of housing has any influence on infant mortality in the first three months of life then it would be expected that the mortality rate would be lowest in the parishes where the state of the housing was best and highest in those parishes which ranked worst (see Table 7.2). Table 7.5 shows that this was so except in the case of the parishes of St. Barnabas and St. Paul. An explanation of the fate of St. Barnabas is that it is probably the result of small numbers when one death can make an exaggerated difference. Cayley's description of the parish of St. Paul provides an explanation as to why that parish is an exception. Cayley acknowledged that, in comparison with Cambridge as a whole, the parish of St. Paul had a greater than average level of overcrowding, less adequate water supply and poorer sanitary arrangements. He goes on to state that these existed in well-defined patches with the worst in the narrow courts between Lensfield Road and Bateman Street (Cayley, 1904: 19-20). Map 2.1 (Chapter 2) confirms this and the narrow courts between Lensfield Road and Bateman Street can be identified. This suggests that the parish of St. Paul was made up of mixed housing and the range of occupations recorded in the Vaccination Birth Registers confirms this. Harvey Road was home to Fellows of the University, in Hills Road there were numerous trades people, and Coronation Street, with its courts and alleys situated between Lensfield Road and Russell Street, was home to the labouring classes. As Cambridge Place was also largely inhabited by labourers it is probably another of Cayley's 'defined patches' where the state of the housing was poor.

Spalding's directory of 1904 confirms the Vaccination Birth Register findings. In Harvey Road six of the twelve occupied properties were home to Fellows of the University (1904: H68-69). In Hills Road trades or businesses were carried out in fifty-three of the one hundred and eighty nine properties. There was very much a mix of size of property in Hills Road with large residential houses located furthest away from the town centre and the trades and businesses carried on nearest to it. (Spalding, 1904: H74-78). Five courts were situated off Coronation Street. In Cambridge Place, along with twenty-seven small houses, there were three stables, one of which was a large enterprise (Spalding C23-24, C39-40). The social mix of residents suggests that the condition of houses in some streets was much better than that in others.

St. Andrew the Less parish and the parish of St. Matthew have much higher levels of infant mortality at ninety days than the other three parishes in the registration district. So are some streets in these parishes healthier than others? Cayley describes St. Andrew the Less as a large district generally known as Barnwell and fairly typical of the poorer parts of Cambridge. This suggests that the nature of the parish was very different to that of the parish of St. Paul. Cayley does state that some streets were 'new and unobjectionable' whilst others were narrow with courts and houses without any through ventilation. One significant feature of the main thoroughfare, Newmarket Road, was that it contained an excessive number of public houses, 22 in under half a mile. [5] The parish of St. Matthew, situated to the south of St. Andrew the Less, was developed in the latter part of the nineteenth century. The houses were described by Cayley as more uniform in character and better laid out than those in the older parts of St. Andrew the Less. It seems that this parish unlike the parish of St. Paul did not contain a mixture of housing, so conditions were standard across the parish. The parish of St. Philip (Romsey Town) was the healthiest part of Cambridge for an infant to be born in.

In order to test whether some streets in the sub registration district of St. Andrew the Less were less healthy than others the q(90days) measure was calculated over a nine year period, 1905-13, those streets that averaged over 10 births per year were selected for investigation. Although from 1912 onwards the registration district boundaries changed, for the purpose of investigation at street level this makes no difference. The streets that averaged at least ten births a year fell within the parishes of St. Matthew, St. Andrew the Less, and St. Philip. In Spalding's directory, Mill Road is divided into two distinct roads, Mill Road (1904: M104-109) and Mill Road over the bridge (1904: M106-109). The Mill Road data in the table below refers to the part of the road,

[5] In England and Wales the number of licensed premises to the population was 1 to 230 but in Cambridge it was 1 to 138 (Rackham in Bosanquet, 1912: 27).

which is over the railway bridge in the parish of St. Philip (Romsey Town).[6]

The average age of vaccination and the number of infants exempted from immunisation could affect the number of infant deaths recorded as occurring during the first 90 days of life. If the proportion of infants exempt from immunisation was high then more infant deaths would be recorded because those infants remained in observation unless the infant died. If the average age of vaccination was low then fewer infant deaths would be recorded because those infants were no longer in observation.

Table 7.6 shows the average age for vaccination in all streets was above 90 days but the actual spread either side of 90 days is wide, varying from under 30 days to over one year. Only 5 to 6% of infants in Fitzroy Street, Great Eastern Street and New Street were exempted from vaccination whereas in the other streets the percentage of infants exempted ranged from 36% to 57%. With so few infants exempt from immunisation in these three streets there is a concern that fewer infant deaths would be

[6] The railway bridge on Mill Road divides the parishes of St. Matthew and St. Barnabas; the number of births in Mill Road north of the bridge, in the parish of St. Matthew, did not average 10 or more each year when the births at the workhouse are excluded. Mill Road then continues on over the railway bridge into Romsey Town (the parish of St. Philip) and births here did average more than 10 a year.

recorded leading to an artificially low q(90 day) measure, particularly if the average age of vaccination was low. Indeed the average age of vaccination in the three streets was low, 106 days in Gt. Eastern Street, 110 days in New Street and 122 days in Fitzroy Street. with a much wider range on either side of the average.

Table 7.6: Percentage of infants exempt from immunisation and average age of vaccination in fourteen selected streets, Cambridge 1905-1913

Street/Road	No. of Births	No. exempt	% exempt	Av. Age of vaccination
Argyle	136	54	40	138 days
Catharine	179	81	45	97 days
East	136	64	41	130 days
Fitzroy	**111**	**5**	**5**	**122 days**
Great Eastern	**101**	**8**	**6**	**106 days**
Gwydir	174	62	36	130 days
Mill	112	53	47	129 days
New	**139**	**8**	**6**	**110 days**
Newmarket	290	103	36	132 days
Ross	121	51	43	133 days
Sedgwick	102	58	57	96 days
Sturton	148	69	47	137 days
Thoday	129	65	50	130 days
York	211	87	41	118 days

Source: Vaccination Birth Registers, Cambridge 1905-1913

However, it does not appear to be the case that the q(90 days) measure was low. Table 7.7 shows that with the exception of Newmarket Road the highest q(90 day) measure was recorded in these three streets.

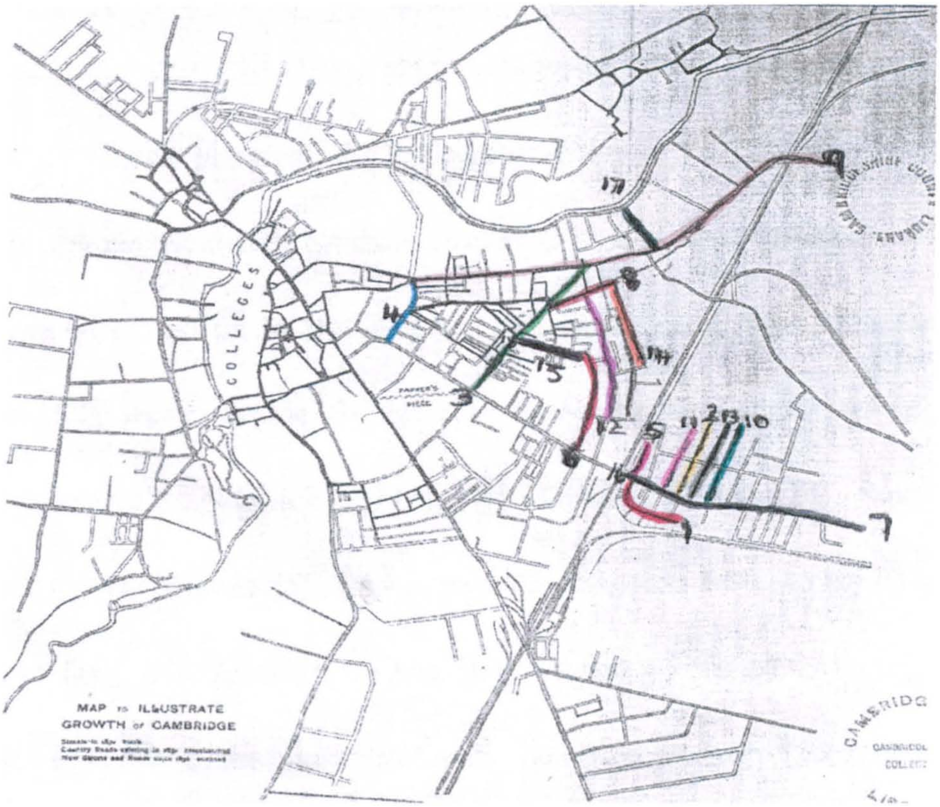
Table 7.7: q(90day) Infant Mortality measure in selected streets, with an average of at least ten births per year, sub-registration district of St. Andrew the Less, Cambridge 1905-1913

Street	Parish	Births 1905-13	Infant deaths prior to vaccination born 1905-13	q(90day)
Ross Street	St. Philip	121	2	0.0083
Sedgwick Street	St. Philip	100	6	0.0209
Thoday Street	St. Philip	129	10	0.0393
Sturton Street	St. Matthew	149	8	0.0405
York Street	St. Matthew	211	17	0.0481
Catherine Street	St. Philip	180	14	0.0518
Mill Road over the railway bridge	St. Philip	110	9	0.0554
Gwydir Street	St. Matthew	174	14	0.0590
Argyle Street	St. Philip	135	13	0.0683
East Road	St. Andrew the Less	154	15	0.0687
Great Eastern St.	**St. Philip**	**101**	**15**	**0.0700**
New Street	**St. Matthew**	**139**	**16**	**0.0757**
Newmarket Road	**St. Andrew the Less**	**290**	**35**	**0.0778**
Fitzroy Street	**St. Andrew the Less**	**111**	**16**	**0.1107**
	St. Paul (1905-13)	563	37	0.0416
	St.Barnabas (1905-13)	298	18	0.0482

Source: Cambridge Borough Vaccination Birth Registers 1905 - 1914 G/C/x vols. 2 to 20 inc.

The findings presented in Table 7.7 suggest that some streets such as Ross Street and Sedgwick Street were healthier than other streets such as Newmarket Road and Fitzroy Street. The map (Map 7.1) shows where the streets were situated and also gives details of the streets in existence in 1830, those built after 1830 and those that were country roads.

Map 7.1: Fourteen selected streets under investigation marked on map showing streets in existence prior to 1830, those built after 1830 and country roads, Cambridge. (For key to map see text below)



Source: Frontispiece, Jebb, 1906

KEY TO STREETS

1=Argyle Street	2=Catharine Street
3=East Road	4=Fitzroy Street
5=Great Eastern Street	6=Gwydir Street
7=Mill Road over the bridge	8=New Street
9=Newmarket Road	10=Ross Street
11=Sedgwick Street	12=Sturton Street
13=Thoday Street	14=York Street
15= Norfolk Street	16=Railway Bridge
17=River Lane	

Jebb's map identifies streets in existence prior to 1830 by marking in bold, country road are crosshatched (so appear grey in the map above) and streets built after 1830 are outlined. As the streets under investigation have also been marked in bold and numbered it is necessary to describe into which of the three categories these streets fell. Streets in existence prior to 1830 included, Fitzroy Street (4), East Road (3) to its junction with Norfolk Street (15), and Newmarket Road (9) from the town end up to the junction with River Lane (16). Streets built after 1830 were; Argyle Street (11), Catharine Street (2), Great Eastern Street (5), Sedgwick Street (11), Thoday Street (13), Ross Street (10), Gwydir Street (6), New Street (8), Sturton Street (12) and York Street (14). Mill Road (7) to the junction with Ross Street (10), East Road (3) from the junction with Norfolk Street (15), and Newmarket Road (9) from the junction with River Lane (16) were country roads. So it seems likely that there was a difference in the age of the properties and the nature of the streets into which infants were born. The thoroughfares of Newmarket Road (9) and East Road (3) were streets in existence prior to 1830 leading away from Cambridge and becoming country roads. Mill Road (7), the third thoroughfare in this sample, was a country road over the railway bridge (17). All the streets in the parish of St. Philip (Romsey Town) were built after 1830, as were those in the parish of St. Matthew.

Spalding's Street and General directory of Cambridge (1904) provides information to show the differing characteristics of the streets. Spalding gives the address of the property, where it was located in relation to other streets, the name and occupation of the householder and uses three font sizes, no indication is given for the different sizes of font but it seems likely that they indicate the size of the property; small, medium or large. Very large bold print is used to indicate non-residential commercial premises. These premises range from large stores e.g. Co-operative Stores to brick works and iron works. Public houses, gardens, building land, stables and other buildings are identified by the use of italics. Public buildings are noted using underlined bold print. The information in Spalding's directory can be used to test the notion that in some streets there was more 'commercial' activity than in others. The range of activity carried out at the non-residential 'commercial' concerns has been identified but properties such as public houses and shops were also residential properties and it is possible to identify these from the information in Spalding's Directory.

Table 7.8: The number of properties in fourteen selected streets: by size and usage, 'commercial/non-residential, residential with commercial use or purely residential, Cambridge 1904.

Street/Road	VLC	Small		Medium		Large	
		R	C	R	C	R	C
Barnwell (Parish of St. Andrew the Less)							
East Road (east side)	5	42	4	43	36		
East Road (west side)	4	5		28	42		1
Fitzroy Street (south side)	5	7	4	17	28	1	12
Fitzroy Street (north side)	9	2	1	12	39		
Newmarket Road (south side)	7	51	10	39	50	5	1
Newmarket Road (north side)	5	89	20	25	22	13	
Parish of St. Matthew							
Gwydir Street (west side)	1			67	27		
Gwydir Street (east side)				69	21		
New Street (south side)		48	10				
New Street (north side)		43	10				
Sturton Street (west side)	1			59	11		
Sturton Street (east side)	2			63	22		
York Street (east side)				59	10		
York Street (west side)				57	4		
Romsey Town (Parish of St. Philip)							
Argyle Street (west side)				74	6		
Argyle Street (east side)				42	3		
Catharine Street (east side)				58	10		
Catharine Street (east side0				51	9		
Great Eastern Street (east side)				40	2		
Great Eastern Street (west side)				39	4		
Mill Road over the bridge (south side)	3			69	39		
Mill Road over the bridge (north side)	1	1		52	20	1	1
Ross Street (west side)				31	2		
Ross Street (east side)				55	1		
Sedgwick Street (east side)				57	4		
Sedgwick Street (west side)				16			
Thoday Street (east side)				61	3		
Thoday Street (west side)				40	8		

Source: Spalding (1904: E46-49; F52-54; G62-63; G 65-67; N113-118, 119; S159-160, 170-172 Y196-198; A7-8; C26-27; M106-109; R146-147; T176-177).

Key: VLC = very large non-residential commercial premises; R = residential premises; C= residential premises where commercial activity was carried out

The results of a search of the directory of the fourteen selected streets are shown in Table 7.8. The font size is taken to indicate relative size of property and the 'commercial' activity carried out in residential properties is that of various types of shopkeepers and publicans. The fourteen selected streets were located in three areas of the sub-registration district of St. Andrew; Barnwell, St. Matthew and Romsey. Table 7.8 shows that the property profile of the streets in each area was very different. Very large, non-residential commercial premises were located in each of the three streets in Barnwell. The nature of the 'commercial' activity carried out in these properties varied, in Fitzroy Street varied retail activity was carried out, in East Road the activity was of a manufacturing nature and whilst in Newmarket Road there were brick works, iron works, stone masons, maltings, builders premises and offices. From Table 7.8 it can be calculated that in Barnwell there were 235 small properties, 361 medium sized properties and 33 large ones. The majority (60%) of the medium sized properties were residential with a commercial use. This is not surprising as it has already been noted (Chapter 3) that Newmarket Road had a high proportion of public houses for the length of the street. If the very large, purely commercial premises are excluded and the percentage of commercial activity by number of premises is calculated on each side of all the streets, then the south side of Fitzroy Street had the greatest amount of activity, with 74% of premises carrying on commercial activities. Sixty-four per cent of the properties on the north side of Fitzroy Street also carried out commercial activity. Commercial activity was also carried on in Newmarket Road, but not to such a great extent as in Fitzroy Street, 39% on the south side and 25% of properties on the north side being involved in commercial activity. All but one of 19 larger properties in Newmarket Road were residential and situated on the town end of Newmarket Road. Most of the smaller properties in Newmarket Road, were in the crowded yards, courts and passages on the south side of the road.

The property profile of St. Matthew differed from both Barnwell and Romsey. There were less large, non-residential, commercial premises than in Barnwell. New Street stands out from the rest of the fourteen streets as all the properties were small and, it can be calculated, that a minority of these (18%) were residential with commercial use, public houses and corner shops. The properties in the remaining three selected streets in St. Matthew were all medium sized and a minority (20%) were residential with a commercial use similar to that of New Street.

Seven of the selected streets were located in Romsey and, here, Mill Road stands out as having a different profile to the other six streets. In Mill Road there were four very large, non-residential commercial premises all carrying out retail activity. There was also one large residential property used as a butchers shop. Of the 180 medium sized residential properties 33% were also used for 'commercial' activity. The remaining six streets were essentially residential with medium sized properties and only 8% of these also carried out 'commercial' activity and were either public houses or corner shops.

Spalding also listed where gardens, stables, sheds and warehouses were situated. In Table 7.8 it can be seen that on the west side of Sedgwick Street there were no commercial properties and only 16 residential properties, whereas on the east side there were 57 residential properties plus 4 with commercial activity. This was because on the west side of the street from the Mill Road end to where St. Philip's Road crossed Sedgwick Street "The Lodge Estate Grounds" were situated. On the east side of the road facing these grounds were 28 houses and nearest to Mill Road there were gardens. At the rear of the gardens on Catharine Street were stables and stores and behind the 28 houses on the east side of Sedgwick Street were 34 houses in Catharine Street

(Spalding, 1904: C26-27). At the far end of Sedgwick Street was a hedge across the street, alongside this were stables belonging to the last house on the east side (Spalding, 1904: S159-60). From this information it seems that, apart from the stables at the rear of the street and those at the end of the street, Sedgwick Street was a pleasant place to live. Flies would have been drawn to the horse manure and could have acted as a vector in the spread of infant diarrhoea, as discussed in detail in Chapter 9. Of the six infant deaths occurring in Sedgwick Street in the period 1905-1913 not one of the infants lived in the properties on the east side facing "The Lodge Estate Grounds" (Vaccination Birth Registers 1905-1914). Table 7.7 shows that Sedgwick Street was second only to Ross Street in terms of the lowest infant mortality in the first 90days of life in the period 1905-1913. In Ross Street the two infants dying in the first 90 days of life in the period 1905-1913 lived on the east side of the street. There were no stables in the street, but two building plots, one on each side of the street. There were three areas of gardens on the east side of the street, with St. Philip's Boys School and playground situated on the west side adjacent to St. Philips's Road (Spalding, 1904: R146-47).

In contrast, infants living in properties in Great Eastern Street did not fare as well in the first 90 days of life as those in Sedgwick and Ross Streets. Great Eastern Street ran alongside the Great Northern and Eastern Railway line but apart from a carpenter's workshop adjacent to Mill Road, Spalding does not indicate any other buildings, stables or gardens. There was a wall across the street at the far end away from Mill Road (Spalding, 1904: G62-3). The map indicating the streets (Figure 7.1) shows that Great Eastern Street was shorter in length than other streets in Romsey Town. When Great Eastern Street and Ross Street are compared it seems likely that the housing density must have been greater in Great Eastern Street, 85 medium sized houses, against Ross Street, 87 medium sized houses in a street nearly twice as long (Spalding, 1904: R146-47). Houses which were closer in proximity would result in the inhabitants of Great Eastern Street not only being subjected to the smoke from the trains but also having less access to fresh air as their homes were closely packed together.

From this evidence it must be concluded that more commercial activity took place in Fitzroy Street and Newmarket Road, than in the other streets. Streets such as Great Eastern Street had houses in close proximity whilst in New Road all the houses were in the 'small' category.

East Road and Mill Road over the bridge in Romsey Town also had more 'commercial' activity. Although the section of Mill Road from Parker's Piece to the Railway Station is not included in our fourteen selected streets the information in Spalding's Directory shows that it had even more commercial activity with six very large commercial premises on the south side and 62 residential properties where commercial activity was carried out against only 12 purely residential properties. The picture on the north side was similar with three very large commercial properties, five large and thirty medium sized residential properties and seventeen residential properties where commercial activity was carried out (Spalding, 1904:104-109).

With the exception of Fitzroy Street the 'commercial streets' were major thoroughfares. The streets in Barnwell (the parish of St. Andrew the Less), were all 'commercial streets', whereas, with the exception of Mill Road, those in Romsey (the parish of St. Philip), were all residential. There was a mix in the parish of St. Matthew with New Street and York Street being essentially 'residential' and Sturton Street and Gwydir Street having a more 'commercial' focus, although not to such a great extent as the streets in Barnwell. From this evidence it can be deduced that the environment of each parish, and the streets within that parish, varied considerably. Environmental factors have been found to have less importance on mortality in the first month of life than later on in infancy and childhood (Garrett *et al,* 2001: 196).

The Vaccination Birth Registers do not allow robust infant mortality rates to be calculated beyond 90 days but the Infant Death Registers for Cambridge are available from 1912 onwards and provide the details of all infants dying in the first year of life. This allows us to calculate the cohort infant mortality in 1912 and 1913. Whilst it is recognised that we are not able to calculate this measure for the all the years 1905-911 and that we are dealing with small numbers of infants Table 7.9 gives us an indication of the infant mortality rate for the first year of life of infants born in the fourteen selected streets.

It can be seen from Table 7.9 that Ross Street is still one of the healthiest streets, but surprisingly, for the years 1912 and 1913 infants born in Fitzroy Street also survived to their first birthday. Infants born in New Street were not as likely to reach their first birthday as their peers born in any of the other thirteen streets.

Table 7.9: IMR in selected streets, Cambridge 1912-13

Street	N births	N deaths	IMR	N deaths over 90 days of age	Ranking
Argyle	25	3	120	2	10
Catherine	39	3	77		5
East	39	3	77	2	5
Fitzroy	22	0	0		1
Gt. Eastern	24	3	125		12
Gwydir	33	4	121	1	11
Mill	26	1	38	1	3
New	25	6	240	4	14
Newmarket	68	7	103	2	9
Ross	25	0	0		1
Sedgwick	25	4	160	2	13
Sturton	35	3	86		8
Thoday	25	2	80	2	7
York	54	4	74	1	4

Source: Vaccination Birth Registers, Cambridge 1912-14, Infant Deaths Register, Cambridge 1912 -14

One of the problems when dealing with small numbers is that one or two deaths make a real difference to the results and this is the case with Sedgwick Street. This street ranked third with the q(90days) measure but two infants dying in 1912/13 after the age of 90 days resulted in the IMR for these years being ranked 13th out of the fourteen streets. If data was available giving infant deaths up to the child's first birthday for the years 1905-1911 then this would provide more conclusive evidence when considering the impact of environmental characteristics at street level since these characteristics are more likely to have an impact after the first month of life.

Twins

Twins and multiple birth infants were more vulnerable during the first month of life than singleton born infants. They were more likely to be born prematurely or at a low birth weight and at risk of failing to thrive. Therefore given the small number of births involved in calculating the street level mortality rate then these births could easily distort the findings. It is for this reason that table 7.11 compares both the q(30 day) and q(90 days) measure with and without the inclusion of twin and multiple births.

Table 7.10: Comparison of infant mortality in selected streets by q(30days) and q(90days) with and without twin and multiple births included, Cambridge, 1905-1913

Street/Rd	q(30 days)	q(30 days)*	q(90 days)	Q(90 days*)
Argyle	0.0519	0.0534	0.0683	0.0704
Catherine	0.0278	No change	0.0518	No change
East	0.0195	0.0133	0.0687	0.0636
Fitzroy	**0.0901**	**0.0686**	**0.1107**	**0.0906**
Gt. Eastern	0.0594	0.0206	0.0700	0.0313
Gwydir	0.0345	0.0349	0.0590	0.0597
Mill	0.0364	0.0377	0.0554	0.0575
New	0.0288	0.0222	0.0757	0.0702
Newmarket	0.0207	0.0142	0.0774	0.0646
Ross	0.0083	No change	**0.0083**	**No change**
Sedgwick	0.0100	0.0102	0.0209	0.0213
Sturton	0.0336	0.0345	0.0405	0.0416
Thoday	**0.0000**	**No change**	0.0393	No change
York	0.0379	0.0296	0.0481	0.0400

Source: Cambridge Borough Vaccination Registers 1905 - 1914 G/C/x vols. 2 to 20 inc.
All located at Cambridge Records Office, Shire Hall, Cambridge.
* Excluding twins and multiple birth data

Twin births occurred in all streets except Catherine Street, Ross Street and Thoday Street. Of the 23 sets of twins born in the streets over the nine years 1905-13, 15 sets were alive at 90 days of age, in 4 sets one twin was alive and of the remaining 4 set both infants died before 90 days of age. One set of triplets were born in Fitzroy Street and all three infants died in the first week of life. In Table 7.11 the mortality rates in the streets with the lowest and highest mortality rates are printed in bold. Fitzroy Street has the highest rate on all counts. The data in Table 7.11 should be interpreted at two levels, firstly the difference between the two mortality measures, column 2 and 4, and secondly the impact on those measures of the removal of twin and multiple birth data.

Table 7.10 ranks each column in order of best (1), i.e. lowest mortality measure, to the worst (12), or highest mortality measure. When considering columns 2 and 4 of Table 7.10 one striking feature is that some streets, in particular East Street and Newmarket Road, appear relatively healthy for infants in the first month of life but the reverse is true when the first three months of life are considered. The reverse is true for Sturton Street and York Street. The ranking of the four streets at 30 days and 90 days demonstrates this clearly. When comparing mortality at 30 days (column 2) with mortality at 90 days (column 4) York Street (moves 6 places up) and Sturton Street (moves 4 up). Whilst the reverse is true of Newmarket Road (moves 8 places down) and East Street (moves 6 down).

Table 7.11:*Comparison of ranking of infant mortality in selected streets by q(30days) and q(90days) with and without twin and multiple births included, Cambridge, 1905-1913*

Column 1	Column 2	Column 3	Column 4	Column 5
Street/Rd	q(30 days)	q(30 days)*	q(90 days)	q(90 days*)
Argyle	12	13	9	13
Catherine	6	8	6	7
East	4	4	10	10
Fitzroy	**14**	**14**	**14**	**14**
Gt. Eastern	13	6	11	3
Gwydir	9	11	8	9
Mill	10	12	7	8
New	7	7	12	12
Newmarket	5	5	13	11
Ross	2	2	1	1
Sedgwick	3	3	2	2
Sturton	8	10	4	6
Thoday	**1**	**1**	3	4
York	11	9	5	5

***Source:* Cambridge Borough Vaccination Registers 1905 - 1914 *G/C/x* vols. 2 to 20 inc.**
All located at Cambridge Records Office, Shire Hall, Cambridge.
* Excluding twins and multiple birth data

So why is the measure worse at 90 days in some streets but better in others? Singleton born infants generally have a heavier birth weight making them more likely to thrive and survive the first weeks of life, whilst twins tend to have a lower birth weight and be born prematurely making then prone to failure to thrive. Two sets of twins were born in Gt. Eastern Street and all four infants died in the first month of life. When these four infants are removed from the calculation the result is a much lower infant mortality measure both at 30 days and at 90 days. Therefore when looking at the reasons for the decline in infant mortality it is important to consider the impact of twin births on the calculation of the mortality rate. Removal of the twin births in the calculation of q(30days) in Gt. Eastern Street changes the ranking of the street against the other streets at 30 days from thirteenth position to sixth position. The impact is even more dramatic at 90 days, from eleventh position to third. If the impact of twin births were not identified then it would be easy to conclude that in Great Eastern Street environmental factors related to where an infant lived were more important than personal or parental characteristics. Great Eastern Street was situated beside the railway line with the result that during pregnancy the mother would be regularly inhaling high levels of carbon monoxide because the smoke from trains contaminated the air. The result would be similar to that seen in women who continue to smoke cigarettes during pregnancy i.e. a lower birth weight baby with a greater chance of dying from Sudden Infant Death Syndrome, SIDS (DoH, 1998). In the late nineteenth and early twentieth centuries SIDS was given as 'overlaying'. It is suggested that as the effect of the smoke from the trains may well have resulted in a lower birth weight infant then the effect on twins would have been worse as they were already likely to have a lower birth weight. So in the case of twin births in Gt. Eastern Street personal and environmental characteristics affected the infant in *utero* making it more vulnerable in the first weeks of life.

Part of Argyle Street was also situated beside the railway line. Here two sets of twins were born between 1905 and 1913 but the evidence suggests that they did not suffer in the same way. Since these infants were exempted from immunisation we know that they survived the first year of life because no date of vaccination was given, neither did they die before reaching their first birthday. The impact of removing these four healthy infants from the calculation led to Argyle Street falling to thirteenth position in the ranking of streets. So the removal of twin and multiple births did not always lead to an improved ranking, particularly if the infants survived beyond the third month of life.

In Fitzroy Street the removal from the calculation of triplets and three sets of twins, in total nine infants - four of whom died in the first month of life, led to a fall in the infant mortality measure but made no difference to the ranking of Fitzroy Street as the most unhealthy of the fourteen streets. Except, as shown in Table 7.9, in 1912 and 1913 when no infants died before reaching their first birthday.

If the state of housing played a part in the difference in infant mortality then it would be expected that the houses in the streets where infant mortality was lowest would be of a better quality than the houses in the streets with the highest infant mortality. One way in which this could be tested was to compare the average rateable value (RV), of all the houses in a street where an infant was born/lived, against the q(90 day) measure. If the state of housing were implicated in infant mortality then it would be expected that streets with a high average infant mortality rate would have a low average rateable value. There are two issues that should be taken into account when calculating the average RV of the houses where infants lived. In the time period 1905-13 many families had more than one birth but not all families had the same number of births. Secondly more than one family occupied some houses. In order to overcome this each house was counted only once regardless of the number of infants born there between 1905-13. It has already been shown that more commercial activity was carried out in some streets in than others. The properties where commercial activity took place commanded a higher rateable value so the range of rateable values is given in Table 7.12. The number of properties of which the average is taken is also given in the Table. The 1910 Land Value data has been used to establish the rateable value of the properties in the fourteen streets.

Table 7.12: Comparison between Average Rateable Value (ARV) & infant mortality in fourteen streets, Cambridge 1905-1913

Street	Total number of houses	ARV	No. under £10	No. over £10	Range of RV £'s	q(90 days) minus multiple births
Fitzroy	51	£13.18s	28	23	2-40	0.0906
Mill	66	£12.6s	29	37	6-43	0.0575
East	56	£11.6s	37	19	3-64	0.0636
Newmarket	126	£11.0s	78	48	3-44	0.0646
Gwydir	85	£10.0s	58	27	5-40	0.0597
Sturton	74	£10.0s	63	11	5-150	0.0416
Thoday	60	£8.8s	59	1	6-44	0.0393
Ross	59	£8.4s	45	14	5-13	0.0083
Sedgwick	54	£8.0s	47	7	6.5-11	0.0213
Catharine	94	£7.8s	92	2	6-10.5	0.0518
Argyle	58	£7.6s	57	1	5-13.5	0.0704
Gt. Eastern	51	£6.10s	50	1	6-13	0.0313
New	63	£6.0s	58	5	2.5-28	0.0702
York	97	£5.16s	97	0	4.5-8	0.0400

Source: Duties and Land Values Record of Valuation 1910 470/026; 470/027; 470/028; 470/029; 470/030; 470/031; 470/033 Cambridge Vaccination Registers 1905-1914 G/C/x vols.2 to 20 inc. All located at Cambridge Records Office, Shire Hall, Cambridge.

A striking feature of Table 7.12 is that Fitzroy Street, the unhealthiest street (except in 1912 and 1913) had the highest average rateable value. It can be seen from Table 7.12, then that, high average rateable value does not equate to low infant mortality. High average rateable values do understandably that we have identified as 'commercial', namely the three thoroughfares, Newmarket Road, Mill Road and East Road. Fitzroy

Street, although not a main thoroughfare, was also identified as a street with commercial activity.

When the range of rateable values is taken into account, Fitzroy Street had a range from £2 to £40 while those with a rateable value over and under £10 almost equally distributed. Do those houses with a rateable value of £2 play a part in this? There were only three infants born into a household living in a property with a rateable value of £2. The properties were situated in Compass Passage and all three infants survived past four months of age. The range of rateable values of the properties where it was known that infants did not survive the first year of life was from £5.10s to £28.

New Street with a range from £2. 10s to £28 also had a high mortality measure and the lowest-but-one average rateable value of the fourteen streets, at only £6. Again the infants known not to survive to their first birthday did not live in the lowest valued properties. The properties where they lived ranged from £3.10s to £9. A similar picture emerges with Newmarket Road and East Street where infants living in the lowest value property, £3, survived the first three months of life. If we look at the streets where the survival rate was best, Ross Street and Sedgwick

Street, infant deaths did not occur in the properties with the lowest rateable value.

Thus, there is no positive relationship between high rateable values and low infant mortality nor is there one between low rateable value and high infant mortality in the first three months of life in these fourteen streets. Garrett *et al* found that environmental factors were likely to have been less important in the first month of life than later on and that it was mortality at older ages that was particularly susceptible to environment (2001: 196-7). We were able to calculate a robust mortality at one year in the years 1912 and 1913 (Table 7.9). In those years Ross Street was still one of the healthiest streets and New Street one of the unhealthiest but there were surprises. Fitzroy Street was one of the best instead of the worst and the reverse was true for Sedgwick Street. To test this out further a full picture is needed for the other years and this was not available. What has been apparent is that streets with a higher than average mortality rate also had a higher than average amount of commercial activity and these streets did not figure amongst the streets with the lowest mortality rate in the fourteen streets, except in the case of Fitzroy Street in 1912 and 1913. The conditions experienced in all fourteen streets in 1912 and 1913 need further investigation. Argyle

Street and New Street, with a low average rateable value experienced high mortality although they had low commercial activity. The only conclusion that can be drawn from these findings is that the streets in the parish of St. Philip (Romsey) fared better than those in other parishes. Those situated furthest from the railway track fared better than all the other streets. So it seems that environmental factors or 'environmental characteristics' cannot be completely discounted as having an effect on infant survival in the first months of life.

Parental occupation is often used to determine social status. The Vaccination Birth Registers give details of the father's occupation and when analysing the fourteen streets by occupation 132 different paternal occupations were found. Of these 71 were mentioned once only. Of the remaining 61 those mentioned most frequently were, labourers (349 times), railway employees (175), shopkeepers (103 times), carpenters (57 times), bricklayers (42 times) and painters (31 times). It must be recognised that some occupations may have been over-represented because the occupations of the fathers of all the infants born in the years 1905-1913 have been counted. For instance seven infants living in Thoday Street had a father whose occupation was bricklayer but six of the children belonged to the same family. So the occupation of this father was counted six times rather than once. When carpenters and painters were investigated a similar situation was observed. In York Street nine infants had a carpenter as a father but four of these infants belonged to one family and three to another. Five infants in Argyle Street had a father who was employed as a painter and four of these infants belonged to the same family. A similar picture can be observed in all the fourteen streets. If each infant is counted it can be seen that occupations of those fathers with the most children will be over-represented in the sample but time constraints precluded a complete check to overcome this problem.

When the paternal occupation of infants dying in the first three months of life in the fourteen streets was analysed the following results were found for each occupation:-

36 occupations - one death recorded

6 occupations – two deaths recorded

Bricklayers – three deaths recorded

Carpenters - four deaths recorded

Blacksmiths - five deaths recorded

Painters - nine deaths recorded

Labourers – thirty deaths recorded.

As would be expected the most deaths occurred in the most frequently occurring occupations, with the exception of blacksmiths. On closer investigation four of the five deaths where the father was a blacksmith were all in one family, with one set of triplets being born to this family, all of whom died in the first week of life. The most commonly occurring occupations amongst fathers have been selected for investigation, namely, labourers, carpenters and bricklayers.

Table 7.13: Percentage of births to families headed by men in seven selected occupations, 14 selected streets, Cambridge 1905-13

Street	No. births	Bricklayer		Butcher		Carpenter		Clerk		Engine Driver		Labourer		Painter	
		No	%	No	%	No	%	No	%	No	%	No	%	No	%
Argyle	136	3	2.2	1	0.7	2	1.5	0	0	4	2.9	26	19	5	3.7
Catharine	180	5	2.8	5	2.8	6	3.3	1	0.6	5	2.8	46	26	10	5.6
East	156	5	3.2	2	1.3	0	0	1	0.6	0	0	35	22	5	3.2
Fitzroy	111	0	0	5	4.5	3	2.7	0	0	0	0	18	16	2	1.8
Gt. Eastern	101	0	0	0	0	0	0	1	1	2	2	22	22	4	4
Gwydir	174	6	3.4	9	5.2	16	9.2	2	1.1	0	0	14	8	10	5.7
Mill	112	0	0	6	5.4	8	7.1	6	5.4	1	0.9	2	1.8	3	2.7
New	139	4	2.9	0	0	0	0	0	0	0	0	86	62	0	0
N'market	290	8	2.8	6	2.1	3	1	4	1.4	0	0	105	36	3	1
Ross	121	5	4.1	1	0.8	6	5	6	5	3	2.5	30	25	0	0
Sedgwick	102	8	7.8	0	0	11	11	6	5.9	4	3.9	6	6	3	2.9
Sturton	148	5	3.4	3	2	6	4.1	1	0.7	5	3.4	6	18	7	4.7
Thoday	129	7	5.4	0	0	20	15	0	0	1	0.8	9	7	1	0.8
York	211	7	3.3	1	0.5	9	4.3	0	0	1	0.5	69	33	5	2.4
Total	2110	63	3	39	1.8	90	4.3	28	1.3	26	1.2	494	23	58	2.7

Source: Cambridge Borough Vaccination Registers 1905 - 1914 *G/C/x* vols. 2 to 20 inc.

Butchers have been chosen to represent shopkeepers, engine drivers to represent railway employees and clerks to represent the professional group.

The data in table 7.13 is drawn from the Vaccination Birth Registers and each infant born between 1905 and 1913 has been counted, no allowance has been made for size of families. What is certain is that labourers made up the largest occupational group in the fourteen streets. The largest group of families headed by a labourer lived in New Street (62%). On the other hand, labourers were less likely to head a family in Gwydir Street, Mill Road, Sedgwick Street and Thoday Street. Carpenters were the next largest group, living predominately in Fitzroy Street, Gwydir Street and Mill Road. Sedgwick Street had the greatest percentage of Bricklayers as head of household.

Table 7.14: A comparison between occupation and infant mortality at 30 days and 90 days, fourteen selected streets, Cambridge 1905-13

	q(30days)	q(90days)	No. of births
Bricklayer	0.0159	0.0492	63
Butcher	0.0256	0.0520	39
Carpenter	0.0111	0.0225	90
Clerk	0.0357	0.0357	28
Engine Driver	0.000	0.0400	26
Labourer	0.0425	0.0718	494
Painter	0.1207	0.1599	58

Source: Cambridge Borough Vaccination Registers 1905 - 1914 *G/C/x* vols. 2 to 20 inc.

A striking feature of Table 7.14 is that infants with a father who was an engine driver fared better than any of the others in the chosen occupational groups. Infants with a father who was a painter fared worst, although here the number of births was very small and the results may be a 'small numbers' problem. When the q(90days) measure for labourers was compared with the findings in Table 7.8 it can be seen that infants born into a family where the father was a labourer were more likely to die in the first three months of life than the families head by a father in the other occupations investigated. Engine drivers (Table. 7.13) generally lived in the parish of St. Philip, the healthiest of the three parishes in which the fourteen streets were situated. Apart from labourers the numbers in each occupational group were low and due to time constraints no account has been taken of the number of infants in a family. Those households with more births could cloud the results because where small numbers are concerned, one death can skew the findings. Due to the problem of small numbers this evidence only suggests that some occupational groups were healthier than others suggesting that personal and family characteristics could affect survival but that environmental characteristics could make a difference.

Conclusion

The first of the four research questions addressed in this chapter sought to establish where the poor lived and the state of the housing where they lived. It was expected that a geographic inequality in the distribution of unsatisfactory housing would be found and that most of that housing would be in the Barnwell district (the parish of St. Andrew the Less and the parish of St. Matthew). Cayley's study showed that low rent (under 6/- per week) housing was present in all Cambridge parishes but St. Matthew had the highest proportion of houses under 6/- rent per week compared to all the other parishes. We have also found that, as expected, the parishes with the best ranking had the lowest q(90days) measure, with the exception of the parish of St. Paul. The parish of St. Paul experienced the lowest mortality rate of the five parishes but ranked the worst by state of housing. What was surprising was that St. Paul appeared to be an unhealthy place to live yet neither the MOH nor Jebb commented on this (see Chapters 3 and 4). There were two reasons for this apparent inconsistency; firstly the unsuitable housing was confined to two distinct parts of the parish and secondly there was a great contrast in housing within the parish. There were the large comfortable homes in Harvey Road, which were largely occupied by members of the University, moderate size houses in Bateman Street and crowded courtyards in Coronation Street and Cambridge Place. In other words here was a parish where affluence and poverty co-existed side by side. The geographic distribution of unsuitable housing was not then as expected, this is suggestive of environmental characteristics making a difference to how healthy one is, but is it environment, income or the influence of wealthy neighbours that is the deciding factor?

The third research question sought to establish whether infant mortality was higher in the streets with the worst housing conditions. Cayley's findings were used to identify the parishes where housing conditions were worst. The streets in the sub-registration district of St. Andrew the Less were investigated in more detail using the data from the Vaccination Birth Registers. Fourteen streets each with an average of ten births per year were selected and these were in the parishes of St. Matthew, St. Philip (Romsey) and Barnwell. The streets in St. Paul's parish were not investigated because no street averaged ten births per year. The findings suggested that in St. Paul's parish, there were some streets that were likely to be less healthy than others but these could not be investigated as the number of births was small. Map 7.1 demonstrated that St. Paul's parish had a range of houses from the most expensive to crowded courtyards where the poor lived in properties with the lowest rent. The parish of St. Philip ranked second best in relation to the state of housing. Although two streets in that parish, Ross Street and Sedgwick Street ranked best of all the streets under investigation, Great Eastern Street, also in the parish, was one of the worst streets. When infant mortality was investigated with multiple births removed, Great Eastern Street was in the top three healthiest streets. It was shown that the housing profile of the parishes was very different and that the environmental characteristics may have had an influence on the infants life chance but when considering the specific family characteristics, in particular father's occupation then it was this that influenced where a family lived. So it seems that some streets were healthier than others but at this very local level the characteristics of individual families in a locality influenced the levels of mortality observed.

The average rateable value of the houses in the fourteen streets was used as a measure to indicate whether the housing was satisfactory or unsatisfactory, it being expected that a low average rateable value would correlate with high infant mortality. As commercial premises have a higher rateable value than non-commercial premises Spalding's directory (1904) was used to establish which streets had a high commercial activity and it was found that this was the case with the three main thoroughfares together with Fitzroy Street. The streets in the parish of St. Philip had the lowest level of commercial activity. Properties used for both residential and 'commercial use' e.g. shops and public houses had a high rateable value but these high average rateable properties did not correlate with low infant mortality. Therefore it might be possible that while properties were commercially valuable, they were actually a health hazard if sited on a street where there was also residential property. The largely residential streets in the parish of St. Philip were tested against the expectation that the higher the rateable value the lower the infant mortality and there was a close match. The two streets, Ross Street and Sedgwick Street with the lowest infant mortality did not have the highest average rateable value. Environmentally both these streets differed from the others in the parish. In Ross Street many of the houses were new, having been built during the period of investigation from 1905-1913. Since Cayley's report would have been presented during this time and new building regulations put in place, it is likely that these houses were of a satisfactory standard with respect to. The second street in St. Philip's parish to rank well was Sedgwick Street, a street that was, on the whole, less crowded because one half of the west side of the street bordered the grounds of an estate house. So in residential streets although higher rateable values tended to be related to lower the infant mortality rates it seems that other factors within the street environment could come into play.

The occupational structure of the fourteen streets was investigated and the findings suggested that families headed by a labourer were by far the largest group, with carpenters, bricklayers and painters the next largest. Infant mortality at 30 and 90 days was investigated in these four groups: butchers, engine drivers and clerks were added to the groups to ensure a balance of occupations. Size of family was not taken into account due to time constraints, but the findings suggested that although occupation of head of household played a part in the life chances of an infant so did where a family lived. It must be remembered that where a family lived also depended on income and therefore occupation. So in answer to the second question where an infant lived did influence there chance of survival to their first birthday.

The impact of where one lived was discussed in Chapter 6 and it was shown that changes in sewage management, purity of water and control of environmental hazards were brought about by pressure on government agencies through those in positions of authority expressing their concerns about general environmental conditions. Even when pure water was supplied to the majority of houses, as it was in Cambridge by 1902, many houses shared an outside tap with others. Thereby increasing the likelihood of the spread of diarrhoea if an infected person handled the tap. The number of household sharing a tap was greater in Cambridge than in either Oxford or York. A change in the standard of housing was also brought about as a result of the CSU's activity in uncovering the inequalities in the state of housing for the town's poor. The changes happened because of the concern, interest and philanthropy of people living in Cambridge who were not directly experiencing poor housing conditions themselves but who chose to act as advocates of the poor who were unable to help themselves. This theme is continued in the next chapter when the role of philanthropy in the development of the infant welfare movement in Cambridge is considered.

Chapter 8: The influence of philanthropic activity

Introduction

A sub-theme running through this thesis has been the role of individuals and groups in driving change forward. In this chapter the theme is made more explicit. Whereas in the previous two chapters the impact of the physical environment on the survival chance of an infant has been explored, in the next two the emphasis will be on the social environment. The diversity of the Cambridge social environment was described in Chapter 3, particularly the gap between members of the University and those of the town. This chapter explores how the elite of the town and those of the University worked together to drive forward changes to improve the health of infants.

Generally the public health response to the threat of diarrhoeal diseases was to improve local sewerage systems and ensure a clean water supply. However from the evidence presented in Chapter 6, it was concluded that, in Cambridge, it seems unlikely that the completion of the sewage management scheme and the provision of clean water were the only factors involved in reducing the spread of diarrhoeal diseases in infants. It was suggested that a more likely disease transmission route was by way of contaminated milk. Milk was the staple food of infants, and the method of infant feeding was of crucial importance for an infant's life chances. In this and the next chapter the role of the infant welfare movement and, in particular, health visiting in promoting breast-feeding or, in the case of artificially fed infants, safer feeding practices to prevent contamination of milk is explored. Improvements to the sewerage system were implemented as a result of pressure from individuals, including the MOH. In this chapter it will be shown that individuals joined together to form voluntary organisations and then worked together to develop infant welfare initiatives.

The research questions addressed are: -

Who led the charitable response to the issue of infant mortality and did the presence of the University have any influence on the problem?

What initiatives were developed in Cambridge in response to the issue of infant mortality?

The Infant Welfare Movement

The infant welfare movement can be seen as the point where the municipal public health response to the high rates of infant mortality met the charitable response. Nationally the Infant Welfare Movement began at the end of the nineteenth century. It was established as a response to the realisation that although the general death rate had declined during the previous fifty years, the rate of infant mortality had not. Indeed, over the later 1890s, it had shown a tendency to increase (McCleary, 1933: 2). The establishment of the movement coincided with the decline in infant mortality at the beginning of the twentieth century, which led to the claim that increased infant survival was a result of its activities. McCleary suggests that new conditions were in place at the beginning of the twentieth century, which explain the decline in infant mortality, and that the infant welfare movement brought about these new conditions (McCleary, 1933: 140-150). Whilst not disputing the importance of the work of the infant welfare movement, historians have argued that the causes of infant mortality are complex and, therefore, its decline cannot be attributed to one set of policies. For instance Lewis questions why health officials were so attached to a particular solution to the problem, namely the education of mothers by health visitors. She writes that there was no doubt that they (health visitors) provided information, companionship and a degree of reassurance for mothers but questioned whether this was the best way to reduce infant mortality (Lewis 1980: 485). Infant welfare services were compartmentalised as a set of personal social services and kept separate from broader socio-economic issues (Lewis, 1980). Williams and Galley, (1995) whilst not disputing the positive effect of the initiatives, question whether they initiated the decline in infant mortality or merely facilitated a decline that had already begun. Meanwhile, Dyhouse suggested the timing of the two might have been a coincidence whilst Williams and Mooney suggested a comparative approach to distinguish the unique from the general (Dyhouse, 1978; Williams and Mooney, 1994). The findings of the latter pointed to a particular combination of social, economic and environmental circumstances at the local level, each of which contributed to the decline in infant mortality (Williams & Mooney, 1994).

What initiatives were developed in Cambridge in response to the issue of infant mortality?

Charitable activity has traditionally been directed towards helping the poor and this chapter explores the notion that charitable or philanthropic activity had a positive impact on the survival rates of infants born to the poor of the town.[1] Poverty was an aspect of Cambridge life largely ignored by the University although Dr Henry Sidgwick, a senior figure in

[1] "The standard definition of philanthropy, or charity, is love of one's fellow man, an inclination or action which promotes the well being of others. It thus includes benevolence within classes as well as between them; it encompasses the widow's mite as well as the momentous decisions of great charities with international connections and legislative programmes" (Prochaska, 1990: 360). "No country on earth can lay claim to a greater philanthropic tradition than Great Britain. Until the twentieth century philanthropy was widely believed to be the most wholesome and reliable remedy for the nation's ills, a view that is not without adherents today" (Prochaska, 1990: 357)

the University, was responsible for establishing the Charity Organisation Society (COS) in the town.[2] He persuaded an out-of-date Mendicity Society to dissolve and then to re-establish itself along the lines of the COS (Ref). The object of this society was to improve the conditions of the poor by promoting co-operation between all available agencies, disseminating information and working with individual cases (Cambridge Charity Organisation Handbook, 1904). Although Dr Sidgwick was influential in establishing and maintaining the presence of the Charity Organisation Society in Cambridge, it was women who carried out the work. The most important figure was Florence Keynes, a University wife, her husband being a Fellow of Pembroke College. She acted as secretary of the Society for many years and recalled how Lady (Roland) Wilson and Miss. Emma Miller, both able women who she reports to be of "strong individuality" aided Dr. Sidgwick. She also commented that she enjoyed the interest and support of Dr. Sidgwick to the end of his life (Keynes, 1950: 61).

[2] Henry Sidgwick (1838-1900) Founder of Newnham College, "one of the greatest figures of Victorian Cambridge and one who helped bring modern Cambridge into being" (Fellows, 1996). The COS was founded in 1869 in London, and attempted to control the distribution of charity so that the poor were encouraged to adopt self-help measure and so become independent (Murray, 1999: 59).

It has been shown, in Chapter 3 that the presence of the University had a strong influence on the type of economic development in Cambridge but that its political influence was weakened in 1856 when the Cambridge Award Act removed some of its privileges.[3] It seems that, at least in the 1880s, socially and geographically town and gown were segregated from each other. Florence Keynes writes "University society was still run on rather formal lines, although modified by the influx (of women) after the statutes of 1882 when Fellows of Colleges were allowed to marry without vacating their fellowships. Dinner parties were frequent and elaborate, the standard being set by the hospitality of the Master's lodge, where it was comparatively easy to provide the seven or eight course dinner with the assistance of the college kitchens" (Keynes, 1950: 53). Keynes also described her early-married days in Harvey Road where the houses were "inhabited almost entirely by members of the University" (Keynes, 1950: 55). Edwards too discusses the spatial and social segregation of the University and Town elites of late nineteenth century Cambridge. She states that "It was more usual, however, for the town elite to live either in the centre of the town or in the larger houses in the new development

[3] Historically University privilege and a corrupt corporation contributed to a divided warring society. In the nineteenth century the term "Town and Gown Riots" came into general use and Parker claims that this war had lasted some 700 years but by the end of the nineteenth century it was essentially over, at least at the top administrative level (Parker, 1987: 157).

east of it" (Edwards, 1987: 63). She goes on to state that "The spatial and social segregation of the University and town elites was reflected in Spalding's Directory of the town (Spalding, 1898: 166-88) which placed residents in two lists: 'Members of the University resident in Cambridge' and 'Other Private Residents' (Edwards, 1987: 63). On the other hand she does state that, "there were some areas of Cambridge life however where the two elites did meet and probably the most important was their co-operation in the philanthropic activities of the Charity Organisation Society" (Edwards, 1987: 64).

By the end of the nineteenth century the role of women began to change both nationally and in Cambridge.[4] One of the influential voices in the first decade of twentieth century Cambridge was Eglantyne Jebb. Eglantyne settled in Cambridge after studying at Lady Margaret Hall, Oxford and Stockwell Training College. Her uncle, Richard Jebb, was Regius Professor of Greek and his second wife, Lady Jebb, belonged to

[4] "In 1876 Cambridge pioneered several university marriages that were working partnerships. This change was brought about by the education of women and the end of celibacy for Fellows; women's voices were beginning to be heard, in harmony or descant" (Fowler, 1996: 11). "A fine example was set too, by some of the senior women and many of the younger arrivals, who took up various forms of social work for which there was great scope, and great need, at that time, when the public authorities were leaving so much to voluntary effort"(Fowler, 1996: 61).

the same ladies dining circle as Mary Paley Marshall.[5] It was Mrs. Marshall who, when approached by Eglantyne for advice regarding appropriate work, suggested she should focus her attention on the poor of Cambridge, directing her to find employment with the COS. Spalding argues that this "... proved a decisive move in Eglantyne Jebb's life, for awareness of the effect of poverty on children in Cambridge led to her concern with the children affected by the famine in Central Europe after the first World War, and ultimately to the creation of the Save the Children Fund, with which her name is inextricably linked" (Spalding, 2001: 112-113).

In June 1903 it was decided that a register of all Cambridge charities would aid the work of the COS and Eglantyne Jebb agreed to produce this. The register aimed to provide reports of institutions and philanthropic agencies to serve as a guide to those in need of access to the help of charitable and other institutions. It also aimed to provide a synopsis of the available means of self and mutual help. Jebb's work on this led her to survey poverty in Cambridge and subsequently to publish her findings in book form (Jebb, 1906).

[5] Mary Paley Marshall (1850-1944) was one of the first five students who went up to Cambridge to become the nucleus of Newnham College. She became the first woman lecturer in economics at Cambridge.

The health of the population of Cambridge must have been of great concern to residents if the response to a meeting called on 5th March 1906 is anything to go by. Eight hundred residents attended the meeting where ways to improve the health of the population were discussed.[6] It was at this meeting that the Cambridge Branch of the National League for Physical Education and Improvement (LPEI) was established. It is not surprising that the outcome addressed the issue of infant mortality, since this was high on the national agenda. Cambridge activists must have been well informed as the meeting in March 1906 preceded by some three months the First National Conference on Infant Mortality held in London in June 1906. The moving force behind establishing the branch appears to have been Prof. Frederick Howard Marsh (1839-1915), Prof. of Surgery at Addenbrookes Hospital, who was to become Master of Downing College in 1907. It seems likely that, prior to the meeting, Howard Marsh would have discussed the issue of infant mortality with colleagues, as Prof. Sims Woodhead was to present a paper at the National Conference. Howard Marsh was considered to be a popular and tactful man. Perhaps that was the reason he chaired the meeting (Rook *et al,* 1991: 252). Although Howard Marsh became known for his orthopaedic work he also wrote on

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[6] The Report of the Interdepartmental Committee of Civil Servants on Physical Deterioration was published in 1904 in response to concerns about the physical standard of recruits for the Boer War. This directed nation wide attention to the health of the nation's youth.

the subject of children, having been assistant surgeon to the Hospital for Sick Children, Great Ormond Street, London in 1868 (Rolleston, 1932: 221). The general committee was eager to get things moving and met only four days later to elect the Executive Committee. The role of the Executive Committee was to determine procedures, prioritise work and nominate sub-committees to carry that work forward (First Annual Report of the Cambridge Branch of the National League for Physical Education and Improvement, 1907).

Table 8.1 gives details of the members of the first executive committee. Mrs. Howard Marsh, wife of Prof. Howard Marsh was Hon. Secretary. The committee was joined later by Walter Eaden Lilley, the grandson of the founder of Eaden Lilley's store in Cambridge. In 1895 he joined the family firm and worked his way through the departments until in 1912 he became head of the company (Ormes, 2000). A. C. Mansfield also joined the committee who, together with Walter Eaden Lilley, funded the first two health visitor posts for a period of two years, from 1906. A third health visitor was appointed in January 1907. Mr. John Chivers, head of the jam-making factory founded by his father in 1873, funded this post. John Chivers was a staunch Liberal and Non-conformist, Justice of the Peace and County Alderman.

Table 8.1: Members of the Executive Committee of the LPEI

President: The Lord Bishop of Ely	
Chairman: Mr. W. Durnford, Mayor of Cambridge and Fellow of Kings College	
Hon. Secretary: Mrs. Howard Marsh	
Mrs. John Clay	Honorary Sec. Cambridge Mothers Union Wife of Mr. J Clay, University Printer
Dr Dalton	Author of *"Cambridge Today: its health life and social condition"* 1908
The Lady Albinia Donaldson	Wife of the Master of Magdalene College. The Rev. Donaldson
Dr. Alex Hill	Master of Downing College
Mrs. Huddleston	Wife of former fellow of Kings College
Miss. Jebb	Author of *"Cambridge a brief study in social questions"*
Mrs. Keynes	Hon. Secretary of Cambridge COS
Mrs. Lord	Salvation Army
Prof. Howard Marsh	Prof. of Surgery, Addenbrookes
Mr. E. H. Parker	Director Barclays Bank
Mrs. Peart	Hon. Treasurer of Cambridge District Nursing Association & Maternity branch
Mr. E. S. Peck	Pharmaceutical Chemist
The Rev. Alderman Pollock	Fellow and lecturer Corpus Christi
Mrs. Clara Dorothea Rackham[1]	Educated at Newnham College.
Mr. W. P. Spalding	Businessman active in municipal and Masonic life. Churchman & Conservative
Mr. Apthorpe Webb	District Medical Officer and Public Vaccinator.
Mr. Herbert Whibley	Businessman. Helped set up Cambridge Improved Industrial Dwellings Company
Prof. Sims Woodhead[2]	Bacteriologist. Presented paper at the first National Conference on Infant Mortality in 1906

Notes: 1) Mrs. Rackham married Harris Rackham in 1901; she went on to become HM Inspector of Factories and a Fellow and Associate of Newnham College, 1915-19. Then she became a JP and a member of Cambridge Borough Council, 1920. 1930 - 32, Royal Commission for unemployment Insurance (Cox, 1936). 2) Sir German Sims Woodhead (1855-1921) Studied medicine in Edinburgh and fellow students elected him to the Presidency of the Royal Medical Society. With A. W. Hare he produced one of the first systematic books on bacteriology in English. He was the first exponent of the new science of bacteriology in Edinburgh and in 1891 contributed to *Bacteria and their Products*. He placed the manufacture of diphtheria antitoxin on a sound basis and carried out investigations into TB for the Royal Commission of 1890. In 1897 he was awarded the British Medical Association Stewart Prize for work in connection with the origin and spread of epidemic disease. As Professor of Pathology 1899-1921, Sims Woodhead organised the pathology department in Cambridge Medical School in 1904.

A list of committee members and benefactors of the health visitor posts provides evidence that the town elite worked alongside members of the University with the purpose of improving the health of Cambridge residents. Attached to the First Annual Report of the LPEI was a list of over 150 subscribers and fourteen Life Fellows. The subscribers paid sums between 5/- and £100 and the Life Fellows £10 each. The subscriptions funded the initiatives including the salary of the health visitors. An appeal was made at the first AGM for more funds to go towards providing additional health visitors.

Not only was the LPEI concerned about the health of the residents of Cambridge but also businessmen were prepared, as we have seen, to back one of the initiatives, namely the employment of the first health visitors in Cambridge. Women and men were more or less equally represented on the committee (10 men and 8 women) but if in 1906 men thought that women would play a submissive role and only be involved when appropriate they were to be disappointed.

The executive committee was instrumental in driving forward an infant welfare programme and the make up of the committee meant that a variety of perspectives were brought to the decision-making element of its work. It would have been interesting to be 'a fly on the wall' when the two committee members Prof. Sims Woodhead and Prof. Howard Marsh debated germ theory. Prof. Sims Woodhead, a renowned bacteriologist, accepted the germ theory, whilst Howard Marsh, like Florence Nightingale, was sceptical of it. [7]

Independently of the LPEI, a milk depot and an infant consultation centre were opened on July 14th 1910 by a group of young mothers. Their purpose was to help those who could not afford expert help and advice for their babies. The mothers' school was born out of this scheme in response to what the voluntary workers felt was an "ignorance of the mothers on practical matters affecting the comfort of the home" (Clapham, 1948). The moving force behind the milk depot was Mrs. Walter Fletcher, later Lady Fletcher; the Chairman of the milk depot committee was her husband Dr Walter Morley Fletcher, Fellow of Trinity College and the treasurer was Mrs. Mellish Clarke. The latter was also very active in the Cambridge District Nursing Association, in 1912 she was Secretary

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[7] Miss. Nightingale believed that proper sanitation, ventilation and the right food would banish much sickness. Writing to Dr. Pattison Walker in 1866 she said that the purpose of medicine should be to "make the public care for its own health". She saw nursing as a sanitary mission. By the same reasoning, Miss. Nightingale was blindly and fanatically against the germ theory of infection. She believed that if conditions that caused ill health could be changed, mankind would become healthy and there would be no need for nurses for the sick, only nurses to promote health (Baly, 1997: 25-28).

and from 1941, taking over from her mother-in-law Mrs. J W Clarke, she became president. Although the Milk Committee developed independently of the LPEI it seems that the two worked closely together as health visitors employed by the LPEI referred the mothers who required a reliable milk supply for their infants to the Milk Depot. In 1914 the Committee of the Cambridge Milk Depot and Mothers' Schools became a sub-committee of the LPEI and in 1915 the Executive Committee of the LPEI decided to transfer their work to the sub-committee (Clapham, 1948).[8] This effectively meant that the work of the health visiting service, infant consultation clinic, milk depot and mothers' school all came under the same management structure. Whilst not disputing that this move was rational, the process is itself interesting. The Milk Depot and Mothers' School Committee, largely led by women, moved to become a sub-committee of the LPEI, largely male led. The reasons for the next move are even more interesting to speculate on. The executive committee of the League transferred their work to the Milk Depot sub-committee. Clapham states that at this stage "two voluntary organisations became one" (Clapham, 1946: 4). So it seems that the League felt that in establishing health visiting its work was complete. Perhaps the wider long-

[8] The sub-committee became known as the Cambridge Voluntary Association for Maternity and Child Welfare. Lady Clapham recorded the history after its final meeting on the 30th August 1946.

term work was viewed as predominately a role for women. In effect a new organisation was created: the Cambridge Voluntary Association for Maternity and Child Welfare. The way the change was effected probably followed some sort of social etiquette for charitable organisations rather than a process to protect the health visitors' terms and working conditions. It seems that as an organisation the League was socially superior to the Milk Depot and had also been in existence for a longer period of time. Therefore as the 'junior partner' the Depot had to be seen to make the move.

The question posed was who led the charitable response to the issue of infant mortality? In the first instance it seems Prof. Howard Marsh; took on that role, but a committee made up of both sexes carried it forward. The majority had links to the University, in the case of the women by marriage or in their own right. The exception was Eglantyne Jebb whose connection was through her uncle. The business people of the town not only served on the executive committee but also, as we have seen, funded the health visitor posts. A second charitable response was initiated by a group of young, well-to-do mothers again with links to the University. So it seems that the University was influential in the development of initiatives that were directed at the issue of infant mortality within the town.

Health Visiting

Before discussing the nature of health visiting in Cambridge, it is necessary to see what the options facing the committee were. It is, therefore, useful here to say something of the origins and development of the service. There is considerable discussion in the health visiting literature regarding the roots of health visiting but the most often repeated account of the first health visitors is that of the Manchester and Salford Ladies Sanitary Reform Association (Dingwall, 1977). Aveson argues that there were two strands to the development of home visiting. Firstly, the visiting of the poor by the rich and secondly visiting the poor and sick by the evangelicals who were not by any means always rich. These women were accepted into the homes of ordinary citizens because a precedent for home visiting had been set by the evangelical work of John Wesley and the Methodists (Aveson, 1987).

Davies (1987) identified three competing models of health visiting from which the health visiting service of the late twentieth century developed: namely the 'Manchester' model, the 'Birmingham' model and the

'Leeds/London' model. The Ladies Sanitary Reform Association (later renamed the Ladies' Health Society of Manchester and Salford) was said to have organised the first system of health visiting in England in 1862. The health visitors who went door to door amongst the poor urging the importance of cleanliness, thrift and temperance were respectable working class women. In 1890 the Society agreed an arrangement with Manchester Corporation to pay a number of health visitors who worked under the direction of the Medical Officer of Health (Owen, 1977: 84-85). Davies argues that by the 1890s the Manchester model was largely in retreat and that the Birmingham model triumphed. In the Birmingham model, the women visitors were educated, preferably with a background in nursing and midwifery and with additional qualifications of the National Health Society or Certificate of Royal Sanitary Institute. Female public health officials were appointed as assistant sanitary inspectors and carried out the home visiting, in the Leeds/London model (Davies, 1987: 95). Cambridge adopted a model that combined the Manchester and Birmingham models. Local women took up paid work as health visitors and trained nurses, who worked in a voluntary capacity, supervised them.

It is interesting that Davies felt that the Birmingham model laid the roots for the requirement for health visitors to be trained nurses. She did not mention that as early as 1892 Florence Nightingale established a type of health visiting course, which ran for one year only at the North Buckinghamshire Technical College. The subjects included the science of hygiene, physiology, home sanitation and "observational visits"; the last mentioned giving instruction on what to observe and how to visit. Twenty women commenced the course, only twelve took the final examination and only six of these passed. In 1900 a two-year course was set up specifically for health visitors and school nurses. The Royal Sanitary Institute conducted the final examination (Wakemen-Reynolds, 1987: 162). Although Davies discounted the London model of health visiting, history shows the professional organisation of 21st century health visitors was established as a result of women sanitary inspectors carrying out the work of health visitors. The association of Women Sanitary Inspectors was formed in London in 1896 and is now the professional organisation and trades union for Community Practitioners and Health Visitors (CPHVA). Its objective was to promote the knowledge of sanitary science for woman sanitary inspectors and health visitors. The objectives of their work were as follows: -

1. *"To reduce the mortality of infants by sending health visitors before and after the birth of a child to visit mothers and instruct them regarding their own health, to impress upon them the importance of*

breast feeding, and in case artificial feeding is necessary to give advice on the subject. As a consequence of improper feeding a large proportion of babies die and many of the survivors suffer from rickets or tuberculosis".

2. *"To provide a fund for sending to the seaside or into the country, mothers, children, and others in delicate health, when such a course is likely to prevent the development of tuberculosis or other serious disease".*
3. *"To assist in the promotion of knowledge of the following subjects, amongst others: a) cleanliness, b) ventilation, c) general sanitary conditions, d) precautions against infection, e) foods, including milk, f) simple cooking, g) temperance, h) proper clothing, i) care of teeth".*
4. *"Generally to assist every effort to benefit the health of the people and to stimulate public opinion on the subject".*

(Jerrome, 1996: 217)

Infant mortality was obviously of great importance to these early women sanitary inspectors and health visitors because within the Women's Sanitary Association they established an Infant Mortality Committee. This committee acted as a pressure group and at their executive meeting on 21 January 1907 it was resolved that steps would be taken to secure representation on the Council of the National Conference on Infantile Mortality (Dopson, 1986).

There is evidence that research was carried out to determine the appropriate model of health visiting for Cambridge. The Committee asked the Hon. Sec. of the LPEI, Mrs. Howard Marsh, to contact Mr. Benjamin Broadbent, Mayor of Huddersfield, Miss. Boileau of Wakefield and Mrs. Hardie of Manchester for information in respect of the work done by Health Visitors in these towns (First Annual Report, National League for Physical Education and Improvement, 1907).

In Cambridge in 1906 the sub-committee formed to consider and report on the appointment of two health visitors consisted of Dr. Dalton, Mrs. Keynes, Professor Howard Marsh, Mrs. Rackham, and Mr. Apthorpe Webb. Mrs. Howard Marsh was appointed Honorary Secretary. Cambridge adopted a model of health visiting similar to the Manchester model, although subsequently across the country health visiting was finally organised along the lines of the Birmingham model. Local women were employed as health visitors and were supervised by two Lady Superintendents working in a voluntary capacity. The Lady Superintendents were Mrs. Howard Marsh and Mrs. Weekes, both qualified nurses. As well as reporting the activity of the health visitors to the LPEI the superintendents worked closely with the Medical Officer of Health. Two residents of Cambridge were nominated for the position of Health Visitor on a trial period of one month. They proved suitable and were to be appointed for one year. The salary was £1 a week, subsequently raised to 25 shillings. The health visitors started work on the 4th June 1906 in the district of Barnwell. The amount of training Cambridge health visitors received is not recorded. It seems likely that it did not involve any formal training as they acted under the supervision of the Lady Superintendents and were instructed by them on what information to give to mothers. The first Annual Report of the LPEI, dated January 1907, included a 'statement of the work done by the health visitors' and this confirms this supposition. The 'statement of work' is essentially a one-page report detailing the number and type of visits made by the health visitors, the management structure and the process for sharing information on the birth of a baby. The statement does not contain statistical information as, "The period which has elapsed since the health visitors were appointed is too short" (First Annual Report of the Cambridge Branch of the League for Physical Education and Improvement, 1907: single page insert). The type of work done by the health visitors fell into two categories, firstly instructing mothers on the management and feeding of infants and secondly inducing the heads of families to keep their rooms in good order. With regard to the feeding of infants it states that under the direction of Mr. Apthorpe Webb, District Medical Officer, a simple method of protecting milk from infection by flies and dust had been devised and the health visitors demonstrated this to mothers. The statement also makes clear that "the health visitors had been directed never, in any circumstances, to offer anything approaching medical advice, or of the nature of medical treatment", (First Annual Report of the Executive Committee, 1907)

In January 1907 a 'statement of work done by the health visitors' was presented to the executive committee of the LPEI. The Health Visitors kept records on cards of distinctive colours: blue cards for infants, pink for tuberculosis cases, and green for general cases. None of these cards appear to have survived but this information shows that the health visitors were not simply employed to visit mothers with new babies. The following statistics, drawn from the statement of work, shows what the health visitors did. In the first four months after their appointment, the report showed that the health visitors had made 1,645 visits to 609 different cases. They discovered that 65% of infants were fully breast-fed - a much lower figure than in most other places (Fildes, 1992) - and that the importance of breast-feeding was, as quoted in the statement, 'constantly and strongly urged' (First Annual Report of the Executive Committee, 1907).

For hand fed babies the danger of using a long tube was pointed out and a safe form of bottle advocated. Additional advice was given on cleaning this and keeping the milk free from infection by flies and dust. The health visitors were also concerned about the general hygiene in the home and the occupants of 235 houses were said to have followed the advice given and cleansed and brushed down the walls of their home. Forty rooms were re-papered and whitewashed; 60 backyards cleaned up and closets lime washed. Occupants were also encouraged to open windows. The condition of 46 houses was reported to the Medical Officer of Health who had the power to ensure landlords made satisfactory improvements. By the end of the first seven months the two health visitors had made a total of 3,352 visits to a total of 875 cases of which 621 were infants. Between 400 and 500 infants had been weighed at regular intervals and their progress recorded. The number of houses reported to the Medical Officer of Health as being in an unsatisfactory condition had risen to ninety-one. (First Annual Report of the Executive Committee, 1907)

A summary of the work of the Cambridge Branch of the LPEI states that the Lady Superintendents worked closely with the Cambridge Board of Guardians, the Charity Organisation, the District Nurses Society, and the Society for the Prevention of Cruelty to Children, the Good Samaritan Society, the Church Army and the Salvation Army as required. (First Annual Report of the LPEI, 1907) Although there is no evidence that the health visitors were concerned with cases of child protection the fact that they worked closely with these organisations is evidence that the Lady Superintendents were involved in this aspect of the work of health visiting.

Preventive Aid Committee

Following the inaugural meeting of the LPEI the Preventive Aid Committee was elected. The chief objective of this committee was to send delicate children into the country for a change of air. In 1907 two mothers and their infants plus 65 children were sent to homes near Royston where they were under the supervision of ladies resident in the neighbourhood. The average length of stay was three months. The sending of delicate infants and their mothers to the country suggests that there was recognition of the part played by poverty and unsavoury living conditions in the ill health of infants and children. The Preventive Aid Committee received referrals from health visitors. One of the Lady Superintendents of the health visitors, Mrs. Weekes, sat on the committee.

Lecture Committee

The lecture committee was not solely concerned with the education of mothers. The evidence shows that the lectures it arranged were aimed at women, men, girls and boys as well as those working amongst the poor of Cambridge. It must be remembered that the meeting, which set up the LPEI, arose out of a concern for the health of all the people of Cambridge. Although the executive committee of the LPEI decided to focus in particular on the health of infants it seems that it recognised everyone had a role to play in bringing about an improvement in health generally. The committee arranged 44 lectures to be given during the Lent term of 1907. The topics included housing and sanitation; hygiene, management of babies, home nursing, vaccination, first aid, prevention of infection, foods including milk, temperance and cooking. The lecturers included medical men and were given at various clubs, including mothers' meetings. The lectures were also aimed at the workers amongst the poor (First Annual Meeting of the Cambridge Branch of LPEI, 1907), although a notice advertising a course of 12 lectures on hygiene was obviously not aimed at such an audience as a fee of 5/- was charged to cover expenses.

The notice can be found in the LPEI folder in the Cambridge Collection, Cambridge City Library, it is not dated.

Initiatives developed by The Milk Depot and Mothers' School Committee

In the last two decades of the nineteenth century the first milk depots were set up in France and America. The first *Consultation de Nourrissons* were linked to maternity hospitals where women returned weekly for advice. In France Prof. Pierre Budin set up the first *Consultation de Nourrissons* at the Charité Hospital, Paris in 1892 and his second, in 1895 was placed in the Maternité Hospital, Paris. Breast-feeding was encouraged, the baby weighed and, for those mothers unable to breast-feed sterilised cow's milk was provided. By 1903 there were twenty five *Consultation de Nourrissons* in Paris of which twelve were dependent on private charity, the rest were funded publicly (McCleary, 1933: 42-46)

At the same time, unaware of the work of Prof. Budin, Dr. Léon Dufour, working in the provinces, set up the first *Goutte de Lait* in Fécamp (McCleary, 1933: 46). This was supported by private subscriptions. Any mother could bring her baby for advice on breast-feeding and supplementary feeding. For those unable to breast-feed, clean milk was provided free for those unable to pay but at a cost for others according to their income (McCleary, 1933: 46-47). The First International Congress of the *Goutte de Lait* was held in 1905 in Paris. Delegates from Great Britain attended and on June 13-14 1906 the First National Conference on Infant Mortality was held in London. Prof. Sims Woodhead, the Cambridge bacteriologist and member of the Executive Committee of the Cambridge Branch of the LPEI, spoke on "Alcoholism in Relation to Infant Mortality" at this conference (McCleary, 1933: 105-106).

The Infant Welfare Movement in France concentrated on the promotion of breast feeding, the medical supervision of infants and the provision of specially prepared cow's milk for those infants whose mothers were unable to breast feed. In contrast, the Infant Welfare Movement in America concentrated on the conditions under which cow's milk was prepared for infant feeding. The milk reformers in America were divided into two groups, with Nathan Strauss leading those who promoted the pasteurisation of milk. Dr. Henry Coit led those who advocated certified clean milk from herds that had been tuberculin tested (McCleary, 1933: 55-61). The first Strauss Milk Depot was established in New York during 1893. Pasteurised and modified pasteurised milk was provided for infants at less than cost price for poor mothers. By 1902 Strauss had established 14 milk depots in New York and in 1905 he addressed the British Medical Association in Leicester describing his work. He claimed that the fall in infant mortality in New York City between 1893 and 1902 was largely the consequence of the work of his depots.

Dr. Drew Harris opened the first milk depot in England in 1899, in St. Helens, but it was not until June 1910 that "a movement was started by a small Committee, working in co-operation with the Cambridge Health League, to endeavour to supply clean pure milk to those mothers who are unable to nurse their infants" (MOH report, 1911: 52). The object of the committee was to reduce infant mortality, to prevent infection by tuberculosis and to improve the condition of the poor by ensuring a safe food supply during the first year of life (MOH report, 1911: 52). The method adopted in Cambridge for the provision of pure milk is described in the MOH report for 1911 and was as follows: -

1. A reliable milk supply was to be obtained from a herd of cattle guaranteed free from tuberculosis, housed and milked under clean conditions.
2. Milk was diluted and modified according to definite formulae, for different age groups of children.

3. The quantity of modified milk required for a single feed was placed in a bottle, which was then sealed with a stopper.
4. The milk was pasteurised by keeping it at a temperature of 160 degrees Fahrenheit for twenty minutes.
5. Sufficient bottles for 24 hours were placed in a wire basket ready for collection.
6. Rubber teats were supplied.
7. The mother warms the milk by placing the bottles in hot water, removes stopper, replaces it by a teat and the feed is ready.

Source: MOH report, 1911: 53.

So the milk supplied by the milk depot in Cambridge was certified free from tuberculosis and pasteurised in the bottles. The work of the milk depot started at the District Nurses' Home building at 34, Newmarket Road. This was rented, fitted out and in use from January 1911 (Clapham, 1948) No evidence can be found in either Clapham's history of Child Welfare Services or the Medical Officer of Health Reports as to the source of the funding for the rent or the alterations to the building.

As a result of a successful experiment using dried milk in place of pasteurised milk the Milk Depot was given up in May 1914 and dried milk was distributed at Infant Consultation Centres run by the LPEI. The dried milk was distributed at cost price on the recommendation of a physician to those mothers who attended the centre. By 1914 the LPEI were holding weekly infant consultations at three centres: the District Nurses Home in Newmarket Road, the Institute in Romsey Town and St. Paul's Institute in New Town. In addition a session was held every fortnight at the Mission Room, Castle End (MOH report, 1914: 78).

The Cambridge District Nursing Association: Maternity Branch (CDNAMB)

"The object of the association was to provide trained and certificated midwives for those respectable married women whose husbands did not earn more than £1 per week, and where the combined earnings of husband and wife did not exceed 25s per week" (COS Handbook, 1904: 72). No mention is made of those women who were not married and one can only assume that they did not receive the care available from a trained midwife during their confinement, possibly contributing to the higher infant mortality rate for illegitimate infants shown in Chapter 4. It appears that poor women who were married had better care during and after their confinement than unmarried pregnant women. This is assuming that the married women could find the 5/- they had to pay towards the care the midwife provided. Of the 842 births in 1902 the maternity branch provided a midwife for 192 or 23% (COS Handbook, 1904: 72).

Even the care that women received in the workhouse at 81a Mill Road was questionable since the *Cambridge Chronicle* in 1911 gives details of the Inspector's Report to the Local Government Board "The nursing staff was wholly inadequate. It consisted of one partially trained nurse, who was responsible for the whole of the nursing and also the maternity work". The report went on to state that although a new midwifery ward had recently been erected on the workhouse site there was no provision for hot or cold water, no midwifery register, and no records of babies' weights. The inspector recommended that the whole of the existing arrangements were remodelled on modern lines (*Cambridge Chronicle*, April 28th 1911).

Conclusion

We set out to examine whether or not there was evidence of the elites of the University and the town working together to bring about change with relation to infant health. The evidence in this chapter shows that they did indeed work together to bring about change which had an effect on the health of infants. Breast feeding, which was known to have a positive effect on infant health, was promoted by the health visitors who were employed by the newly established LPEI. Members of the LPEI executive committee were drawn from both the University and the town who came together, not this time to bring pressure to bear on others, but actually to work, as a group, to establish infant welfare initiatives aimed at improving the health of infants. As would be expected from such a committee, where members had a combination of skills and experience, the question of which model of health visiting to establish in Cambridge was well researched. The role of health visiting in relation to infant mortality is pursued in the next chapter. It was anticipated that members of the University would bring particular expertise in a variety of fields. The information in Table 8.1 demonstrated that not only did the members of the University come from a wide range of backgrounds but that residents of the town were also able to provide a range of perspectives. The funding for health visiting came from businessmen but the subscribers to the LPEI came from both University and town families.

When infants were artificially fed the health visitors encouraged safer feeding practices and in addition a milk bank and an infant consultation centre was established by a group of young mothers with links to the town and the University. The milk bank provided clean bottled milk for a nominal charge to poor mothers who were not breast feeding their infants and at the consultation centre they were able to get advice from a doctor. The health visitors worked closely with the staff from both the milk bank and the consultation centre.

There was an indication that the executive committee of the LPEI had a longer-term view of how all the separate initiatives would work in closer co-operation. For instance, the milk depot in 1914 came under the umbrella of the LPEI and dried milk powder was issued at the LPEI Infant Consultation Centres.

No evidence was found of any recorded meeting between those who were ultimately members of the LPEI executive committee. As Sims Woodhead was to speak at the National Conference on Infant Mortality (NCIM), it seems likely that at least some informal conversation took place as regards infant welfare and what could be done about it. It is somewhat surprising that although Sims Woodhead's lecture at the NCIM was on alcohol and infant mortality, there is no mention of action being taken in Cambridge to reduce the level of alcohol consumption. This was particularly surprising, as the number of public houses per head of population in Cambridge was far higher than in England and Wales as a whole. Jebb, in her study of social problems did mention the need for temperance but her comments were largely to do with college servants (Jebb, 1906: 95).

By establishing the health visiting service and other infant welfare services the elites of the University and the town had an impact on the health of infants in Cambridge. Whether or not infant mortality declined as a result of their actions, in particular as a result of establishing health visiting will be discussed in Chapter 9.

We have looked at what was done in Cambridge as regards sewerage provision, housing, milk supplies and the setting up of health visiting. We now turn to the impact of the last mentioned on infant feeding, before attempting to assess the relative role of each upon infant mortality rates in Cambridge.

Chapter 9: Health visiting and infant feeding

Introduction

In the previous chapter the charitable response to infant health and the emergence of the infant welfare movement in Cambridge was outlined. This chapter focuses specifically on health visiting itself, the aim being to determine the part played by Cambridge health visitors in the decline in infant mortality. It was in health visiting that the charitable response and the public health response to infant mortality met. [1]

Measuring the effectiveness of health visiting

In Chapter 1 the problems associated with measuring the effectiveness of health visiting were discussed. A major problem when trying to assess the effectiveness of health visiting, in Cambridge in the early part of the twentieth century, is that no health visitor records relating to individual clients have survived. Data from the MOH reports will be used but unfortunately does not give the district in which families lived, let alone the details of the individuals visited. Clapham wrote the history of the service when it moved from the voluntary sector to the newly formed National Health Service in 1948 and this together with the surviving

[1] McCleary, writing in the 1930s, refers to the co-operation between local health authorities and voluntary organisations as an important feature of 'modern' public health work (McCleary, 1933:85).

records of the establishment of the LPEI in 1906 provide the background to the service. There is no way to know whether the infants whose birth details are recorded in the Vaccination Birth Registers also received a health visiting input but despite the lack of available information related to individual patients an assessment will be made of the effectiveness of health visiting at the community level. For the purpose of this thesis the four principles of health visiting are used as a framework for analysing the tasks undertaken by health visitors in the early twentieth century (see Chapter 1 for a discussion of the principles of health visiting).

Other historians are looked to for alternative methods of assessing the effectiveness of health visitors. Lewis has explored the argument that as the health visiting service was by no means universal in the first decade of the twentieth century, then any decline in infant mortality could not be attributed to health visiting alone (Lewis, 1980). She notes that large caseloads, the number of births allocated to each health visitor, meant few and brief visits to families who did have a health visitor, making it unlikely that infant welfare services alone were responsible for the decline in mortality (Lewis, 1980: 464). Mooney used three criteria to measure the effectiveness of health visiting and argued that the contribution of health visiting should not be taken at face value because there was no equality of service provision (Mooney, 1994). Reid used a different approach, targeting factors which were generally linked to higher mortality. She used a data set based on records of Derbyshire health visiting activity from 1917-1922 and examined the visiting patterns to assess three things. These were firstly, whether the health visitors targeted their visiting on groups most in need; secondly, whether accurate advice was given and, finally, whether that advice was likely to have improved health and survival. She concluded that there was some modest targeting of factors linked to high mortality, for example medical conditions such as *ophthalmia neonatorum*[2]. The universally provided service of Derbyshire health visitors impacted on health by changing childcare practices, which together with environmental changes improved health in the long term (Reid, 2001). Measuring accurately the impact of health visiting is as problematic for health visitors in the twenty first century as it is for historians assessing the value of the work of health visitors a century earlier. "Demonstrating the effectiveness of health visitors is not easy as many of their interventions are non clinical; the whole range of input from health education to general advice and support

[2] *Ophthalmia neonatorum* is defined as the inflammation of the eyes in the newborn contracted during the passage through the birth canal, which may be gonorrhoeal or purulent (www.answers.com)

to mothers cannot be easily measured by tangible indicators" (Wain and Shuttleworth, 2000: 72).

Historians also question whether the advice given was well received. They argue that the social class of the health visitor could present a barrier to acceptance but health visitors came from different backgrounds and their social class usually depended on the way the service was set up.

> *"Popular myth suggests that it (health visiting) was done by strong willed, hard faced busybodies, well-heeled ladies of the upper middle classes, a myth no doubt fuelled by contemporary caricatures such as Mrs Pardiggle and Mrs Jellyby described by Charles Dickens in 'Bleak House'. Indeed in some towns other than Manchester and Salford, ladies of the sanitary associations did undertake visiting. The Manchester and Salford women were from the humbler lower classes and many of these women had experienced for themselves much of the deprivation they came across when visiting" (Aveson, 1987: 557).*

If local women were used their background may have been little different from the women they visited, but if professional women were employed then their experience of life would have been very different from that of the mothers they came into contact with. Dyhouse argues that, however sound the advice given, if it was offered in a condescending and patronising way then it would not be well received (Dyhouse, 1978). There is, however, evidence that in some cases advice was well received and that it did make 'a unique and lasting contribution to welfare work' (Dwork, 1987: 69). Szreter cites Buchanan's study of eight mining communities where it was suggested that health visiting could have had a considerable educational effect (Szreter, 1988: 29-30).

To summarise, historians doubt the significance of health visiting for the decline in infant mortality on two fronts. They argue, firstly, that since health visiting was not a universal service then a national decline in infant mortality cannot be attributed to it. Secondly, that the educational effect of health visiting is in doubt, because, it is argued, there was resistance to the message due to the manner in which it was delivered. However, when the message was heard and heeded then it could be a contributory cause of the decline in infant mortality.

The evidence in this chapter tests the proposition that, in Cambridge, by the activity of health visiting the life chances of an infant could, in the early twentieth century, be improved. First, it will be argued that there is evidence to show that the Cambridge health visitors visited further afield than the poor in the parish of St. Giles and those living in the Barnwell district. Second, using Mooney's criteria, the "extent" and "depth" of visiting in Cambridge will be assessed, as will the health visitors' competence to carry out the role. Reid's method of assessing the impact of health visiting cannot be replicated as no similar data set has survived in Cambridge, but her approach will be discussed using the evidence that is available. It has already been shown that sanitary measures and improved housing contributed to the decline in infant mortality. Finally the work of the health visitors will be examined in relation to in each of the four principles of health visiting. It is expected that it will be found that Cambridge health visitors contributed to the decline in infant mortality by bringing about changes in feeding practices in Cambridge, this activity relates to the fourth principle of health visiting, namely the facilitation of health enhancing activities.

Where in Cambridge did the health visitors visit?

The proposition that health visitors played a part in the decline in infant mortality is challenged, as we have seen, both because health visiting was not a universal service and in places where health visitors worked their caseloads were too high for them to be effective (Lewis, 1980; 464). In Cambridge the first two health visitors were employed in the Barnwell district and the third in Castle End, in St. Giles parish. This suggests that their visits were confined to the families living in those areas, but a comparison of the numbers of their cases with the number of births shows otherwise. Although there are no surviving records of individual cases, the number of cases visited can be calculated by using the information the health visitors were required to report to the MOH. This included the number of infants being breast fed entirely, those breast fed partly, those not breast fed at all, those fed wholly or partly on cows' milk, those fed wholly or partly on condensed milk and those having other foods added. The number of infants in each of these six groups who died in the first year of life was also recorded. These statistics were reported annually by the MOH.

From 1906-1909 the Medical Officer of Health also recorded the numbers of infants who were not included in his report on infant feeding methods. The reasons why an infant's feeding history was not included fell into three groups. The first were infants who died in the first four weeks of life due to conditions present at birth, which could not be related to feeding practice. The second group comprised those who died and for whom no feeding history was available. The third group of infants who were not included were those who, whilst still alive, had not been visited by a health visitor. The health visitor did not visit until the doctor or midwife had discharged the family. She then only visited those families where the service was 'required and welcomed' (MOH Report, 1909:76). It is from these feeding statistics that the proportion of families who were not visited by the health visitor can be ascertained.

Table 9.1: Cambridge 1906-1909: Percentage of families where feeding method reported on by a health visitor

	1906	1907	1908	1909
N of all births	650	801	758	864
N of births on which feeding method reported	544	676	608	746
% of births on which feeding method reported	83.7	84.4	80.2	86.3
N of births not reported on - deaths before 4 weeks	13	13	7	32
N of births not reported on - deaths no feeding history	3	11	27	7
N of births not reported on - alive but not visited	90	101	116	79
Total N of births not reported on	106	125	150	118
Total N f births not reported on as % of total births	16.3	15.6	19.8	13.7

Source: Medical Officer of Health Reports, Cambridge, 1906:11-12, 1907:14-15, 1908:14-15, 1909:77.

Table 9.1 shows that in Cambridge the percentage of infants not visited by a health visitor varied from between 9.1% and 15.3% of all births known to the health visitor. The total number of cases in 1906 is lower than in subsequent years because the first two health visitors started work in June 1906 and worked only in the Barnwell district. In 1907 a further health visitor was employed to work in Castle End. It is necessary to clarify where these areas were in relation to the Vaccination Birth Register sub-districts and those of Cayley described in Chapter 7. The Barnwell district covered the parishes of St. Andrew the Less and St. Matthew that were part of the St. Andrew the Less sub-registration district, whilst Castle End, in the St. Andrew the Great sub-registration district covered the area north of the River Cam in St. Giles parish. It seems likely that these areas were chosen because, as reported by the MOH, infants living in Barnwell were more at risk from infantile diarrhoea (Chapter 4) and families living there were considered to be socially comparable to those living in Castle End (MOH report, 1880: 8-9). It appears that in Cambridge a degree of targeted visiting took place. The criteria for receiving visits by the health visitor were where the family lived and its social status.

The Vaccination Birth Registers give the addresses of all births registered in Cambridge. Those born in the Barnwell area in 1907 totalled 405 and those in Castle End, 67, a total of 472 births. So it would be expected that in 1907 the health visitors would have made visits to 472 families, whereas in fact they visited a total of 676, a difference of 204. Some of the difference may be accounted for by families moving into the area but they cannot all be accounted for in this way. The total number of births in Cambridge in 1907 was 814 so the data in Table 9.1, therefore, indicates that visiting was not confined to Barnwell and Castle End. This presents a problem when comparing infant mortality between areas experiencing health visitor input with those not visited by a health visitor. It cannot be assumed that families living in areas other than Barnwell and Castle End, i.e. Romsey town (St. Philip), Newtown (St. Paul) and St. Barnabas, did not experience health visiting input. It must be concluded that in Cambridge, the health visitors visited the majority of families known to them, as they reported on 83.7% in 1906, 84.4% in 1907, 80.2% in 1908 and 86.3% in 1909 (Table 9.1). As may be derived from the figures shown in Table 9.1 the percentage of families with a live infant who chose not to receive a visit from the health visitor were: 13.8% in 1906, 12.6% in 1907, 13.3% in 1908 and 9.1% in 1909. Although health visitors did not provide a universal service, what they did was a targeted one that extended beyond the original target area.

Reid measured the effectiveness of the health visitors in terms of their success in targeting factors that impacted on infant mortality. Unlike Reid, who was able to show evidence of targeting *individuals*, the Cambridge data only shows the *areas* of the town that were targeted. These were areas where diarrhoea deaths were high, namely Barnwell, and a socially comparable area, Castle End (MOH report, 1880:8-9). However, as we have seen, families outside these areas were also visited.

What was the extent, depth and quality of health visiting in Cambridge?

Mooney, as noted above, in his study of London boroughs (Mooney, 1994) used three criteria against which to measure the effectiveness of health visiting in reducing the IMR, especially during the summer months. The three measures used were the extent, depth and quality of health visiting. The extent was measured by caseload size; the depth by the number of revisits and the quality by the level of training the health visitors received (Mooney, 1994: 168-169). Here, then, a comparison is drawn between Mooney's findings and what we know of the work of health visitors in Cambridge. Two of Mooney's twenty eight London boroughs are chosen for comparison, that where he found the greatest proportion of notified births visited, St. Marylebone, and that where the lowest proportion were visited, St. Pancras.

The extent of the health visitors' work

Mooney measured the "extent" of health visiting by calculating the proportion of births, notified under the Notification of Births Act, which were visited by health visitors in one year. He gives information on all the London Boroughs, including the number of health visitors working in each one. If an equal number of births per annum were notified to each health visitor then it is shown that the total number of births notified to each Cambridge health visitor was considerably lower than the number of births per annum notified to their London counterparts (Table 9.2). Given that, other things being equal, then the Cambridge health visitors had more time to spend with families in need. The infants not visited by a health visitor included those who died before 4 weeks and those who were alive but not visited (see Table 9.1 above for details).

Table 9.2: Annual number of births notified per health visitor and the percentage of those notified who were visited.

Year	Cambridge		St. Pancras		St. Marylebone	
	N notified	% visited	N notified	% visited	N notified	% visited
1906	325	83.7				
1907	267	84.4				
1908	253	80.2				
1909	288	86.3				
1912	380	85.4	4657	20	1350	90

Source: Medical Officer of Health Reports, Cambridge, 1906:11-12, 1907:14-15, 1908:14-15, 1909:77, 1912:
Mooney, G (1994:168-69, Table 3:170-71).

Since after 1909 the Cambridge MOH does not give the same level of detail as that used in Table 9.1 then the information used for 1912 is based on the total number of births in Cambridge and the number of visits to new births as given by the MOH. The increase in the number of births, in Cambridge can be explained by the fact that from 1912 onwards the Borough of Cambridge was extended to include Chesterton, a part of its hinterland.

The depth of health visiting

If the London and Cambridge health visitors had the same number of working hours that the Cambridge health visitors had fewer new babies to visit each year did the Cambridge health visitors carry out more re-visits? The number of re-visits paid to each family by the health visitors in all the London boroughs varied. In St. Marylebone the average number of re-visits was given as 'monthly', there was no indication as to what was meant by 'monthly'. The St. Pancras health visitor made an average of two revisits (Mooney, 1994: 170 Table 3). The first year in which the MOH recorded the number of re-visits made by health visitors in Cambridge was 1909. Table 9.3 suggests that the Cambridge health visitors did indeed spend more time making re-visits to targeted families than did their London counterparts, in at least two cases making up to 40 visits in a year.

Table 9.3: Cambridge number of revisits made by health visitors 1909 -1911

	1909	1910	1911
N of cases visited	746	732	856
N visited 1-9 times	631	625	774
% visited 1-9 times	84.6	85.4	90.4
N visited 10-20 times	106	101	82
% visited 10-20 times	14.2	13.8	9.6
N visited 20-30 times	9	4	0
% visited 20-30 times	1.2	0.5	0
N visited 30-40 times	0	2	0
% visited 30-40 times	0	0.3	0
Total N visited 10 or more times	115	107	82
% visited 10 or more times	15.4	14.6	9.6
Total N of visits made	4050	5095	4159
Average N of visits per birth	5.4	7.0	4.9

Source: MOH Reports, Cambridge, 1909:78, 1910:62, 1911:84.

Table 9.3 shows that the Cambridge health visitors targeted certain families, in 1909 and 1910 around 15% of all families were visited more than 10 times. The number dropped in 1911 to 9.6%. The percentage of infants revisited 1 to 9 times in 1911 was 90.4%, this was higher than the percentage of infants revisited that number of times in the years 1909 and 1910. When the number of revisits made by the health visitors is averaged out over the number of births then the average in 1911 is lower than in either 1909 or 1910. One can only speculate the reasons for this change but it is suggested that there are two contributory factors. Firstly as the health visitors had been in post five years they would have built on the one to one relationship which they had developed with the mothers and were in a position to target more accurately those families which required more intensive visiting and those which did not. The second point, which to some degree is linked, 1911 was a year when the number of cases of diarrhoea was high and the health visitors were required to distribute information regarding the prevention of diarrhoea (see Figure 9.1), so it is likely that the health visitors would have targeted families where this advice was needed. No evidence of the criteria for making those extra visits is recorded in the MOH reports, or elsewhere.

Using this information the number of visits each of the Cambridge health visitors made, per annum, can be calculated. The number of visits made each year by the London health visitors can only be estimated. In St. Marylebone all families with a new born infant received an initial visit but no indication was given as to how many families were revisited by the St. Marylebone health visitors. The St. Pancras families, who received an initial visit were revisited on average twice (Mooney, 1994: 170, Table 3). As only twenty percent of new births were visited in the borough of St. Pancras it appears that targeting for receiving health visiting was done prior to the initial visit, but all those families who received the initial visit also received two subsequent visits (Mooney, 1994: 170, Table 3). This was unlike Cambridge where at least eighty percent of all families were visited at least once (Table 9.2) and between 9.6% and 15.4% of those families received 10 or more subsequent visits (Table 9.3). As, in the case of St. Marylebone where all families received an initial visit, no indication is given of the number of families who receive subsequent visits so it cannot be determined at what stage targeting occurred. It is suggested that it must have been at the initial visit stage because if all families receiving an initial visit also received a subsequent visit it would be physically impossible for a health visitor to make 14,580 visits in one year

(Table 9.4). The number of visits per health visitor was similar in Cambridge and St. Pancras (Table 9.4).

Table 9.4: The *estimated* number of visits, per annum, made by London health visitors compared with the *actual* number of visits made by Cambridge health visitors

	No. cases visited	Total no. visits made	Number of health visitors	Estimated no. of visits made by each London health visitor per annum (Cambridge - actual no.)
Cambridge 1911	856	4,159	3	1,386
St. Marylebone 1912	3645		3	
St. Pancras 1912	931	1,862	1	1,862

Source: Cambridge MOH report, 1911:84; Mooney, 1994:170 Table3
Estimated number of visits= number of cases x 3 visits

How these visits were spread over the number of families differed. In St. Pancras all families received the same level and depth, of visiting, whilst in Cambridge more than 9.6 percent of families received 10 or more subsequent visits, with the result that those families received a greater depth of visiting than the families in St. Pancras. It has been assumed that all the health visitors worked the same number of hours, and if this were so then there were more health visiting hours available in Cambridge to cover a smaller total number of births per annum, with the result that targeting in Cambridge could be a two staged process, in the first instance prior to the initial visit and secondly after the initial visit. In St. Pancras, with less health visiting hours available, targeting of those families likely to need subsequent visiting was made prior to the initial visit and only those families considered to require further visiting were visited.

There is no evidence as to how it was decided which families should receive more visits, either in London or Cambridge. In Cambridge if individual records, such as were available to Reid, had survived they would provide an indication as to why some families were targeted and who made the decision to continue visiting. If, as Mooney suggests, the depth of health visiting can be gauged by the number of revisits then on this measure the depth of health visiting in Cambridge, at least to a small targeted population, was greater than that amongst the London health visitors. Without knowing anything about individual families in Cambridge there is no way of knowing whether or not the population of Cambridge were accurately targeted.

The quality of health visiting

Cambridge health visitors had much smaller caseloads and made more re-visits than did the St. Pancras health visitors, but on Mooney's measure the "quality" of advice offered, gauged by the extent of training the visitors received, Cambridge does not appear to fare so well. The London model of health visiting was to use trained professionals, such as sanitary inspectors or highly trained nurses, to carry out home visiting whereas the model adopted in Cambridge was similar to that of Manchester, with local women employed who were supervised by trained personnel (see Chapter 8).

These local women did not require any formal qualifications to be employed as a health visitor. If they were to be well received by the mothers they would need to have good communication skills, be non-judgmental and empathetic in approach. The Cambridge health visitors, it seems, were not involved in decision making. It was the MOH who decided what information was to be given to parents and it was down to the health visitors to transmit that information effectively. This casts some doubt on the effectiveness of Mooney's "quality measure" when applied to Cambridge.

When the first health visitors came into post in 1906 they were given a pamphlet to distribute. This contained information on baby feeding and nursing (MOH, 1906: 10). An abstract of a report presented by the Lady

Superintendent to the Executive Committee on November 27th 1906 also shows that, as well as advocating safe methods of bottle feeding, the Health Visitors were concerned with the cleanliness of homes (see Chapter 8).

In 1911 there was a national increase in the number of cases of diarrhoea, probably due to the very hot, dry summer. Certainly Andrew Laird, Medical Officer of Health for Cambridge, stated in his report that the excessively hot and dry weather during the autumn was responsible for the rise in infant mortality. He issued the instructions replicated in Figure 9.1, which were made freely available to the people of Cambridge. In his report he recognised the difficulties of storing food because in the old cottages the pantry was usually an unventilated place under the stairs near to the kitchen fireplace (MOH report, 1911).

Figure 9.1 *Cambridge MOH Precautions against diarrhoea,* 1911

BOROUGH OF CAMBRIDGE

PRECAUTIONS AGAINST DIARRHŒA

The very young and the very old frequently die from diarrhoea. This disease is most fatal during the warm months of July, August, and September.

During these months all cows' milk given to children should be boiled directly it is received from the milkman, and afterwards kept covered till used.

Great care should be taken to prevent children under five and old persons eating over ripe fruit. All easily decomposable foods should be eaten only if they are quite fresh.

No food refuse should be placed with the ash refuse from the house, but instead should be burned.

It is necessary, especially in warm weather; to keep all drains clean and well flushed. Drains are kept free from smells by the removal of all particles of dirt, which adhere to the walls or lie in the bottom of the trap. Disinfectants are of little use, as they are quickly washed away, and the dirt in a very short time smells as badly as it did before.

In all cases of summer diarrhoea in infants or in feeble people a doctor should be called in at once, as such cases are frequently rapidly fatal.

If diarrhoea starts, no food, not even milk, should be given. Water to quench the thirst is all that is required until the doctor comes.

How well were the Cambridge health visitors received?

The second point on which historians have challenged the significance of health visiting was whether or not the health visitors were well received. The first report on the health visitors' work states, "In no cases had the health visitors ultimately failed to establish friendly relations" (Clapham, 1948: 3). Clapham gives no indication as to what is meant by the word "ultimately", or whether the health visitor had to make repeated visits before she gained entry. If individual records detailing the health visitor contact had survived the level of the problem of refused entry could be accurately established. It seems that in some cases it took time to establish friendly relations but that in all cases the health visitor was 'ultimately' successful. How much this eventual acceptance had to do with the regular weighing and recording of the infant's weight in a book given by the health visitors and how much to do with the health visitors inter-personal skills we cannot say. Clapham stated that the weight record "excites much interest and promotes a rivalry, much to the advantage of the infants concerned" (1948: 3). In his 1909 report, the Cambridge MOH stated that health visitors only visited families where they were required and welcomed (MOH report, 1909: 76). This indicates that parents had a choice of whether or not the health visitor visited but we do not know how this worked in practice.

The recorded evidence about how well health visitors in Cambridge were received is scanty. The first report of the LPEI states that the health visitors had established what were described as friendly relations with the mothers (First Annual Report of the LPEI, 1907). As visits were only made if they were welcome then it must have been much easier to establish a satisfactory relationship.

Did health visitors have any effect on rates of breast feeding, safe feeding practices and the use of comforters?

If, on the advice of the health visitors, safe feeding practices were adopted where they had not been prevalent before this would show not only that the work of the health visitors was effective but also that they must have been well received. Jebb considered that "in the feeding and rearing of infants we touch a subject on which mothers are in the greatest need of enlightenment" (Jebb, 1906: 91). Thus the effectiveness of the health visitors can be gauged by their success at discouraging the use of, for instance, the long tube with a feeding bottle and the encouragement of breast-feeding.

Breast feeding rates

A considerable body of research indicates that breast fed infants are at a significantly reduced risk of infection (Howie *et al*, 1990). The World Health Organisation commissioned a systematic review of the published scientific literature on the optimal duration of exclusive breastfeeding (World Health Organisation press release, 2 April 2001). The authors of the review, published in 2002, concluded that with the caveat that all infants must be managed individually to avoid insufficient growth and other adverse outcomes, then the available evidence 'demonstrated no apparent risks in recommending, as a general policy, exclusive breastfeeding for the first 6 months of life in both developing and developed countries' (Kramer, Kakuma, 2002: 20). In developing countries, in the twenty first century, the most important potential advantage of exclusive breastfeeding for 6 months relates to the protection it gives against infectious disease morbidity and mortality, especially that due to gastrointestinal infection, diarrhoeal disease (Kramer, Kakuma, 2002: 19). Therefore it must be concluded that, in early twentieth century Cambridge, breast feeding was also an important advantage for infant survival in the first 6 months of life. One problem identified in the investigation into the optimal duration of exclusive breastfeeding was that although exclusive breastfeeding to six months conferred several benefits on the infant and mother it could, however, lead to iron deficiency and possible faltering of growth and micronutrient deficiency. Despite this the report recommended exclusive breastfeeding to six months of age (Kramer, Kakuma, 2002: 19-20).

From 1906 onwards information is available on infant feeding. Although the Cambridge health visitors collected data on numbers of breast fed infants the length of time an infant was breast fed was not recorded in the Medical Officer of Health reports. At the first visit the health visitor recorded how the baby was being fed, either fully or partly breast fed or not breast fed at all. If the infant was not fully breast fed the health visitor recorded what food the infant received, cow's milk, condensed milk or other foods. The 'other foods' were grouped according to what the MOH referred to as Hutchinson's Classification of prepared foods (MOH Report 1907:16) Group 1 included desiccated milks with some addition e.g. Allenbury's, group 2 included farinaceous pre-digested foods e.g. Benger's and group 3 farinaceous foods not pre-digested e.g. Robinson's. To group 3 the MOH added rusks, biscuits or bread sops (MOH report 1906: 13). The MOH stated that proprietary foods should only be given on the advice of a doctor and that no additional foods were required until the child was weaned when bread and milk or bread puddings were added to the diet (MOH 1907: 17)

Table 9.5: Numbers of breast fed infants, Cambridge 1906-1910.

Year	N of births	N births method reported	Entirely breast fed		Partly breast fed		Not breast fed	
		No.	%	%	No.	%	No.	%
1906	650	544	336	61.8 %	109	20%	99	18.2 %
1907	801	678	464	68.4 %	138	20.4%	76	11.2 %
1908	754	608	419	68.9 %	114	18.8%	75	12.3 %
1909	864	746	555	74.4 %	98	13.1%	93	12.5 %
1910		735	585	79%	62	8.4%	88	12%

Source: MOH Reports, Cambridge, 1906:12, 1907:15, 1908:15, 1909:77, 1910:62)

(The data in the 1910 MOH Report contained an error. The total number of births on which feeding method reported was given as 732 but 585+62+88= 735)

Table 9.5 shows that the percentage of mothers totally breast feeding increased over time as those partly breast feeding dropped. There was a fall of some 7% between 1906 and 1907, in the percentage of those not breast feeding at all. Thereafter it remained constant around 12% remained around 12%.

The health visitors collected details of the method of feeding at the first contact with the family, which was after the infant reached its tenth day of life. The mother's decision whether or not to initiate breast feeding would have been made prior to this visit, so it would have been the midwife rather than the health visitor who would be in the position to influence the mother on her choice of method of feeding. The health visitor would have been in the position to influence the mother to continue fully breast feeding rather than introducing other products. The Notification of Births Act (1907) which required a birth to be notified to the local Registrar of Births within 36 hours, came into force in Cambridge on 1st July 1909, enabling the health visitor to make earlier contact with the mother (MOH report, 1909:76). Prior to this a period of voluntary notification from September 1908 to the end of February 1909 had taken place in order to assess the impact the scheme would have if it were adopted in Cambridge (MOH report, 1909:12-13). Table 9. 6 shows that during this period:

> *"80% of notified births were visited by the health visitors within a month of birth, a large proportion (28.5%) were seen within the first fortnight. The position as regards non-notified births was exactly the reverse, 80 per cent not being visited until a month had elapsed since birth, and only 6.1 per cent were visited within the first fortnight" (MOH report, 1909:75-76).*

It was as a result of these findings that the Health Committee decided to ask the Local Government Board to sanction the adoption of the Notification of Births Act (MOH report, 1909:76).

Table 9.6: Time of the first visit made by health visitors a comparison between notified and non-notified births, Cambridge 8th August 1908-17th February 1909

Time of first visit	Notified births		Non-notified births	
	Number	%	Number	%
Within 14 days of birth	35	28.5	12	6.1
15-30 days after birth	64	52.0	26	13.3
More than 30 days after birth	24	19.5	158	80.6

Source: MOH report, 1909:75

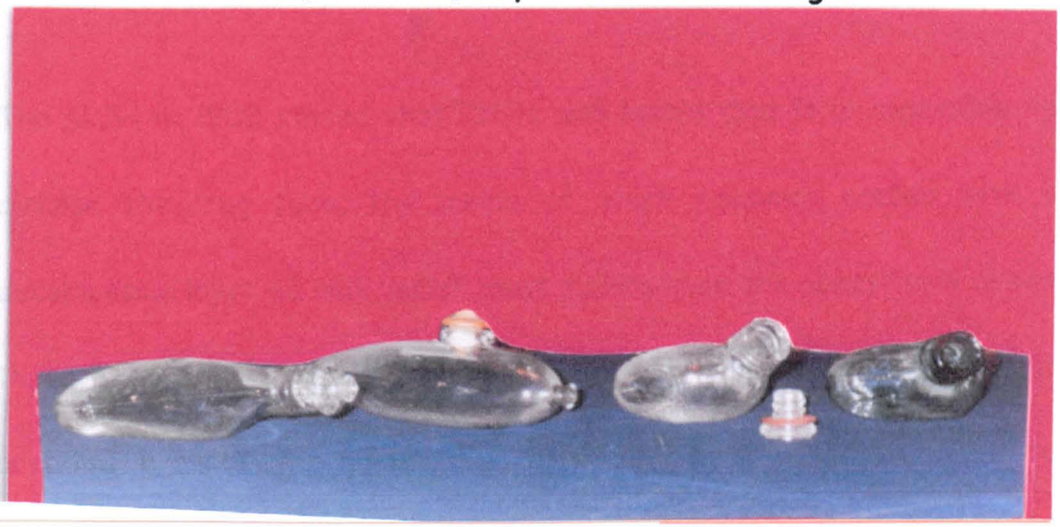
If the age at which the first contact was made dropped as a result of the Notification of Births Act then this could account for the increase in the numbers of mothers fully breast feeding as reported in Table 9.5. When the baby was older at the first visit of the health visitor it is more likely that the mother had changed the method of feeding particularly if the infant was failing to thrive and the mother felt her breast milk supply was not adequate. The first full year of the Notification of Births Act being in place was 1910 but, as noted above, in the last four months of 1908 and the first two of 1909 voluntary agreement was in place. Table 9.5 paints an ambiguous picture for although the numbers of those fully breastfeeding increased after the Notification of Births Act was adopted, it also did so before. The increase from 1906 to 1907 of 6.6% was due to an increase in those "breast feeding", matched by a fall of 7% in those not breast feeding at all. It is unlikely, however that the increase in the one was due to a fall in the other. More likely is that there was a shift from 'partly' to the 'entirely' breast feeding group; and from the 'not breast feeding' to the 'partly breastfeeding group. In subsequent years the increase in the percentage of those mothers fully breast feeding could have been the result of earlier visiting, by the health visitor, and therefore earlier recording of breast feeding status. In 1908 the voluntary agreement for Notification of Births was in place for four months and there was an increase of 0.5% of those fully breast fed. In 1909 the voluntary agreement was in place for two months and the Act was adopted for six months of that year, the percentage of mothers fully breast feeding increased by 5.5%. In 1910 the first full year when the Act was in force the percentage of mothers fully breast feeding increased by 4.6%. These findings suggest that the apparent increase in fully breast fed infants was due, at least in part, to the data being recorded at an earlier date. The challenge for health visitors was to encourage those mothers to continue fully breast feeding their infants. There is no surviving record of infant feeding method at subsequent ages so it is impossible to assess the influence of the health visitor on the maintenance of breast feeding. Neither can the increase in initiating breast feeding in 1907 be ascribed to health visiting influence as this occurred prior to her first visit. The only link that can be made is very tenuous, since health visitors began to visit in 1906 and they promoted breast feeding, then, by word of mouth from mother to pregnant woman, the benefits of breast feeding may have been handed on, encouraging the pregnant woman to breast feed her baby when it was born. Again there is no evidence to show that this happened.

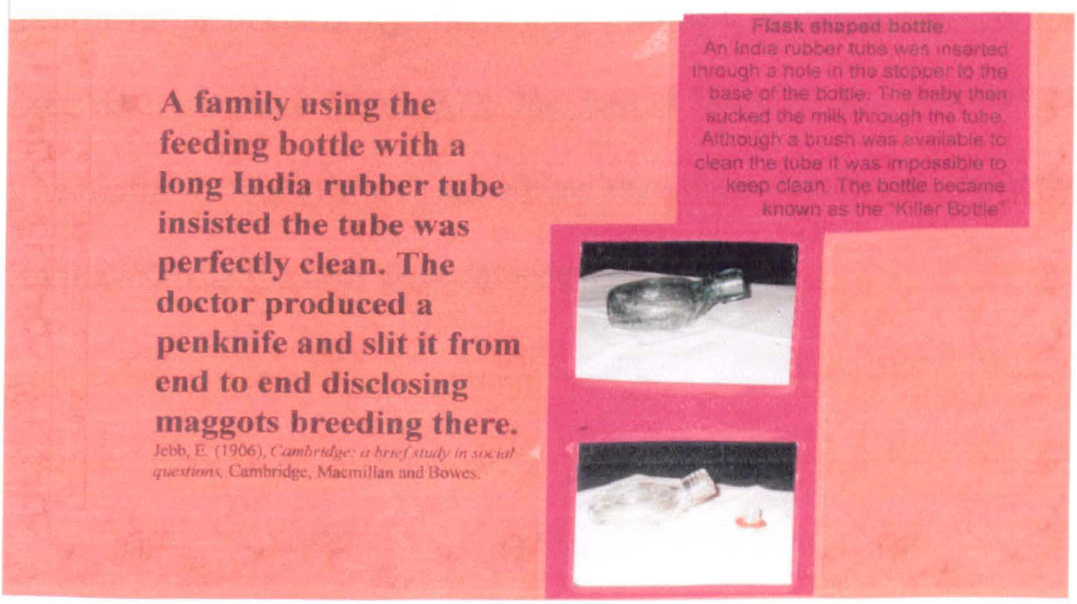
During the period 1906 to 1911 many of the mothers visited by the health visitor would have had more than one birth. For instance those visited in 1906 may well have had subsequent children in 1908 and 1910, thereby having time to be influenced by the health visitor to change their feeding practice. While Table 9.5 is certainly *suggestive* that health visitors may have influenced changes in infant feeding it does not constitute *proof*. One factor to be considered is whether the mothers answered the question truthfully, as they may well have guessed the answer the health visitors hoped to hear and responded in that way. There is no way to determine whether this was so, as the health visitor reports give no indication of the validity of the statistics. In 1907 the MOH reported that, "at first inspection the Health Visitors found that bottles with teats only (not in conjunction with the dangerous long tube) were used in 109 cases" (MOH report, 1907:17). The use of the word inspection suggests that the health visitors were expected to inspect the apparatus used for feeding, therefore confirming the accuracy of the method of artificial feeding (see Table 9.6). However, whatever the effectiveness of early visiting was, it does appear from Table 9.5 that, at least during the six months trial of voluntary notification by doctors and midwives from August 1908 to February 1909, health visitors did in fact make earlier contact with mothers and babies of whose existence they were aware. So they might visit earlier from 1908 onward which might account for more 'exclusively breastfed' babies.

The use of the long tube for infant feeding

One of the most dangerous methods of bottle feeding a baby in the early part of the twentieth century was the use of a flask shaped bottle. This bottle required a long narrow rubber tube to be inserted into the neck of the bottle through a hole in the stopper. The tube was then pushed down to the base of the bottle. The infant then sucked the milk through this tube rather than through a teat, as is used today. The rubber tube was impossible to keep clean because it was so narrow and milk deposits clung to its interior. Fildes argues that a major factor in the decline in infant mortality was the decline in the use of the long tube for feeding (Fildes, 1992:15).

Figure 9.2: The flask-shaped feeding bottle, which required a long tube to be inserted for the infant, to suck milk through.





Source: Bottles the property of Veronica Smoothy, photo J Walsh

Although breast feeding was the optimal choice of feeding method for the health of mother and baby, for those infants who, for whatever reason, were artificially fed, the health visitors promoted safe feeding practices

The MOH in 1908 stated that "It is well known that it is impossible to cleanse the long tube, the inside of which becomes coated with a decomposing layer of milk, which must pollute even the purest milk drawn through it" (MOH report 1908:17). The long tube provided excellent breeding grounds for germs. The health visitors were instructed to discourage the use of the long tube and encourage the use of the bottle, which only required the use of a teat. Amongst the families visited by a health visitor in Cambridge the evidence shows a decrease in use of the long tube over time (Table 9.7). The data in Table 9.7 was collected by the health visitors at the first visit and then these details were reported to the MOH by the Lady Superintendents.

Table 9.7: Number of artificially fed infants being fed using long tube, teat or spoon, Cambridge 1906-1910.

Year	N of births on which feeding method reported	N infants partly or fully artificially fed	N of infants fully artificially fed and method of feeding reported	Teat only		Long tube		Spoon	
				N	%	N	%	No.	%
1906	544	208	144	73	51	62	43	9	6
1907	678	214	168	109	72	46	27	13	1
1908	608	189	128	90	70.3	30	23.4	8	6.3
1909	746	191	140	91	65	37	26	12	9
1910	735	150	95	69	73	20	21	6	6

Source: MOH Reports, Cambridge, 1906:12-13; 1907:15, 17. 1908:15, 17; 1909:77-78; 1910:62; 1911:84.

Table 9.7 shows that the use of the long tube fell between 1906 and 1910 with the greatest change taking place between 1906 and 1907, the health visitors coming into post in June 1906. This does not provide evidence that the health visitor influenced the choice of feeding device. It does show that there was a considerable move towards using the bottle with a teat rather than the bottle with the long tube between 1906 and 1907. What part word of mouth between mothers played in this cannot be measured; nor can the influence health visitors had on word of mouth information sharing. It seems that the MOH felt that the health visitors did have a part to play in bringing about this change. He stated that "A comparison of the above figures (1906-1908) points to the instructions of the health visitors having had an educative influence amongst the Cambridge mothers, for a great effort was made to persuade the mothers to change from the long tube bottle to that with a teat only" (MOH report 1908:17). There is no evidence in the text of the MOH reports as to whether or not the use of a spoon was approved. It is likely that it was used when the infant was fed foods other than cow's milk or condensed milk and as the use of all 'other foods' was discouraged it is likely that the use of the spoon was discouraged.

The use of comforters

Another potential source of infection arose from the use of comforters. It was recognised that families were unlikely to stop using them, so the health visitors attempted to reduce the amount of time they were used. The Cambridge MOH recognised this in his 1909 report: "Short of getting rid of it (the comforter) altogether, the Visitors have to remain content with limiting its use as much as possible and securing it from falling on the floor". (MOH report, 1909: 78).

Table 9.8: The frequency of usage of comforters, Cambridge, 1906-1909

Year	Total N of infants reported on	Consistent use		Occasional use		Not used	
		No.	%	No.	%	No.	%
1906	544	338	62	0	0	206	38
1907	678	338	50	77	11	263	39
1908	608	303	50	88	14	217	36
1909	746	318	43	157	21	271	36

Source: MOH Reports, Cambridge, 1906:14; 1907:15; 1908:17; 1909:77

Table 9.8 shows that as consistent use declined, occasional use grew. Families where a comforter was not used at all remained relatively unchanged. Again, as in Table 9.7 and 9.5 this is a snapshot of activity and does not provide evidence of a change made by individuals, which, it could be argued was brought about by health visiting activity. It does show a reported change in the use of comforters over time so it can be concluded that mothers where aware of what was considered 'best practice'. Since one can well imagine the mother removing the comforter from the infant's mouth when the health visitor came to call and reporting that the baby only had the comforter occasionally these results should be treated with some scepticism. In 1910 reporting on comforter usage was discontinued. Either the statistics on comforters were no longer required or the Medical Officer of Health had given up hope of any real changes being made with regard to their use.

The data collected by the health visitors was a snapshot of infant feeding practice at the time of the first visit. There is no evidence of subsequent feeding practice i.e. when the infant was three or six months of age. Therefore it cannot be concluded with any certainty that changes in practice were influenced by the health visitor. It can be argued that changing feeding practices are the result of word of mouth from mother to mother and that this is influenced by the information given to individuals by the health visitor. If this is so then the evidence provided above does, tentatively, suggest that the Cambridge health visitors did make a difference to the rates of breast feeding and to safer methods of artificial feeding. Their impact on the use of comforters remains in doubt. The percentage number of mothers not using a comforter at all did not rise. What they may have done was to replace the constant use of the comforter by occasional use.

Did health visitors have an impact on infant mortality?

Although the cards used by health visitors to record visits made to individual families have not survived, the Medical Officer of Health Reports do give aggregative information on the mothers visited, including the percentage of infant deaths by method of feeding from all causes, and those from diarrhoea. The MOH data for the years 1906-11 is given in Tables 9.9, 9.10a and 9.10b and demonstrates the benefit enjoyed by fully breast fed infants.

Table 9.9: % of infant dying by method of feeding, Cambridge 1906-1911

Breast feeding status	Fully			Partial			Not at all		
	No.	Died	%	No.	Died	%	No.	Died	%
1906	336	6	1.8	109	6	5.5	99	17	17.2
1907	464	8	1.7	138	9	6.5	76	4	5.3
1908	419	12	2.9	114	8	7	75	13	17.3
1909	555	8	1.4	98	7	7.1	93	7	7.5
1910	585	13	2.2	62	4	6.5	88	4	4.5
1911	435	16	3.7	49	6	12.2	65	11	16.9
Total 1906-11	2794	63	2.2	579	49	7	196	56	11.2

Source: MOH reports, Cambridge 1906:12; 1907:15; 1908:15; 1909:77; 1910:62; 1911:84.

The method of feeding was collected by the health visitors at the first visit and in the case of fully and partially breast fed infants there is no way of knowing how long breast feeding continued. It is not clear from the statistics presented by the MOH whether or not the cohort were followed through to the end of the first year of life or whether his statistics refer to the number of infant deaths in that year. In 1908 the MOH states that, "The following is the result of the analysis of the 608 cases reported on by the health visitors in 1908, and of the 1830 cases for the years 1906, 1907 and 1908" (1908:15). So it seems that the number of deaths does relate to the infants reported on and whether or not they died in that year but if that is so then not all infants were followed through to one year of age.

Table 9.9 shows that those infants who were fully breast fed, at least in the first few weeks of life, were more likely to survive, at least to the end of their year of birth than their peers. Except in 1907 those infants who were partially breast fed, at least in the first few weeks of life, were also more likely to survive than their peers who were not breast fed at all. The aggregate of 1906-11 confirms this finding, Those not breastfed at all may have had a health problem which made them even more vulnerable.

In Chapter 5 it was established that 1906, 1908 and 1911 were peak infant mortality years in Cambridge, the result of an increase in deaths due to infectious disease, respiratory disease and diarrhoea. The percentage of infant deaths amongst infants not breast fed at all was greatest in those years. While partially breast fed infants demonstrate a rise in 1911 the picture for fully breast fed infants shows a rise in 1908, 1910 and 1911. As described above, health visitors made earlier contact with a family following the introduction of the Notification of Births Act.

Therefore feeding status was recorded at an earlier age and in some cases prior to the introduction of any supplementary foods being added to the infant diet. This resulted in more infants recorded as fully breast feeding than was the case when feeding status was recorded later. Earlier recording therefore provides one explanation for an apparent rise in mortality for fully breast fed infants.

The MOH also calculated the percentage of deaths from diarrhoea by method of feeding for the years 1906-1909 (Table 9.10a). This clearly demonstrates the protection against diarrhoeal disease provided by breast milk.

Table 9.10a: % of infants dying from diarrhoea by method of feeding, Cambridge 1906-1909

Breast feeding status	Fully			Partial			Not at all		
	No.	Died	%	No.	Died	%	No.	Died	%
1906-09	1774	3	0.17	459	14	3.05	343	24	6.99

Source: MOH reports, Cambridge 1906:12; 1907:15; 1908:15; 1909:77.

The MOH gives the cumulative details of diarrhoea deaths year on year from 1906 to 1909 and from these the spread of deaths over time can be determined, the details of the number of deaths in each year are given in Table 9.10b.

Table 9.10b: The number of diarrhoea deaths as in Table 9.10a distributed by year of death and method of feeding, 1906-09

Breast feeding status	1906	1907	1908	1909
Fully	1	0	1	1
Partial	4	7	2	1
Not at all	14	3	5	2

Source: MOH reports, Cambridge 1906:16; 1907:12; 1908:15; 1909:77.

The numbers are low so it is hard to draw firm conclusions but 14 deaths in 1906 for infants fed no breast milk at all stands out from the rest. It seems that in 1907 partially breast fed infants did not fare as well as was normally the case; as was noted above in discussion on the findings reported in Table 9.9 when 6.5% of partially breast fed infants died. 1907 was the only year in the period 1906-1911 when the percentage of partially breast fed infants who died exceeded those who were not breast fed at all. Diarrhoea deaths accounted for this difference, 7 of the 9 deaths. Without further details on the individual infants it is impossible to ascertain why this was so.

So did health visitors have any impact on infant mortality? Given that no individual health visitor records have survived and the health visitors' findings as reported by the MOH lack clarity it would be unwise to form firm conclusions. Despite this Table 9.5 showed that patterns of infant feeding changed after 1906 and the changeover from partially to wholly breast feeding was particularly sharp. It was suggested that the earlier recording date of breast feeding status as a direct result of the adoption of the Notification of Births Act partially explained this change. Although it cannot be proven conclusively that health visitors also contributed to changes in patterns of infant feeding it can be suggested that by giving information to individuals this added to the information sharing by 'word of mouth' at the community level. Knowledge about infant feeding practice was, and still is, passed on by 'word of mouth' between women in the local community.

For those women who were unable to breast feed, health visitors gave the mothers information on how artificial feeding could be achieved in the safest way possible but, however careful the mother was, she could not prevent contamination of the milk at source.

What was the role of milk in infant mortality?

Beaver argued that "a further reduction in infant mortality took place at the beginning of (the twentieth) century, associated with the commercial development within the dairy industry which favoured a pathogen-free milk supply" (Beaver, 1973: 254). The work of the Infant Consultation Centres and the Milk Bank has been described in Chapter 8 and the mothers who purchased subsidised, pathogen free milk were encouraged to bring their infants for weighing and consultation with the doctor. In 1911, the first full year of operation, sixty-seven infants in receipt of pure bottled milk were monitored. Two of these died from enteritis (3% or 30 per 1,000). This is very close to the percentage of deaths in fully breast fed infants in 1911 shown in Table 9.9.

Many doctors felt that the provision of milk depots would result in a decline in breast-feeding (Fildes, 1992: 20). Table 9.5 showed that 74.4% of infants in 1909 and were fed exclusively on breast milk, in 1910 and 1911 this figure had risen to 79%. Note, as discussed above, the 1911 figures should be treated cautiously as it appeared that not all the data was entered by the MOH in his report. In 1912 the sub-registration district of Cambridge was extended to include the rural hinterland of Chesterton so if, as the figures suggest, the health visitors expanded their area of visiting then this should be considered in any comparison of breast feeding prevalence. At first glance it would appear that the provision of the milk bank in Cambridge did indeed lead to a decline in breast feeding rates. However closer examination of the health visitor statistics suggest otherwise.

Table 9.11: A comparison of breast feeding practices across time, Cambridge, 1910-1914.

Year	Total N of infants reported on by HV	Fully breast fed		Partly breast fed		Not breast fed	
		No.	%	No.	%	No.	%
1910	735	385	79	62	8.4	88	12
1911	549	435	79	49	9	65	12
1912	699	476	68.1	162	23.2	61	8.7
1913	797	528	66.3	177	22.2	92	11.5
1914	772	490	63.5	197	25.5	65	11

Source: MOH Reports Cambridge 1911:84; 1913:88; 1914:77.

The percentage of fully breast fed infants did, indeed, fall year on year, 1911-1914, but the percentage of partly breast fed infants rose. (Table 9.11). It seems likely that the numbers of fully breast fed infants fell because the diet of some was supplemented by bottle-feeding. This may well have been a positive step as such infants may have failed to thrive without supplemental feeding. Fildes' findings seems to support this as she notes that towns with depots reported that infants brought to the depot were usually in poor health and often close to death before receiving depot milk (Fildes, 1998: 20).

The health visitors collected statistics on the type of milk infants received, since the numbers reported exceeded the total of those infants partly breast fed plus those not receiving breast milk at all it must be concluded that some infants received either two milk products or a milk product plus other foods.

Table 9.12: Artificially fed infants by type of food received, Cambridge 1906-1914. (Some infants received more than one type of artificial food)

	Total N of infants reported on	N of infants receiving cows milk		N of infants receiving condensed milk		N of infants receiving other foods	
		No.	%	No.	%	No.	%
1906	244	116	48	17	7	111	45
1907	291	163	56	18	6	110	38
1908	226	122	54	14	6	90	40
1909	266	124	47	19	7	123	46
1910	240	146	61	13	5	81	34
1911	116	55	47.5	13	11	48	41.5
1912	287	152	53	15	5	120	42
1913	357	193	57	23	7	121	36
1914	362	185	51	27	7	150	41

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Source: MOH Reports Cambridge, 1906:12; 1907:15; 1908:15; 1909:77; 1910:62; 1911:84; 1913:88; 1914:77

Table 9.12 shows the number of infants receiving cow's milk, those receiving condensed milk and those receiving other foods. Condensed milk was considered to present a very real danger to the infant. A large proportion of the brands on sale used machine skimmed milk, not full fat, with the result that the energy levels and fat soluble vitamin levels were depleted. Furthermore, the milk was not made sterile in the canning process and further problems resulted through contamination in the home (Fildes, 1998: 19).

The evidence from Cambridge suggests that contamination was a major problem in 1911, a year when deaths from diarrhoea were high across the country. Some 30.7% of infants given condensed milk died compared with 3.6% of infants entirely breast fed and 16.3% fed wholly or partly on cow's milk (MOH report, 1911:84). There appears to be a large drop in the number of infants receiving cows milk in 1911 but as mentioned earlier in this chapter the data on this year appears incomplete, so it is hard to draw any firm conclusion. It seems likely that the 'drop' was in fact a recording error.

Milk was not the sole food of infants under one year of age. The solids on to which the infants were weaned and at what age the weaning took place was a matter of concern for those advising on childcare (as they still are a century later). It seems that proprietary foods were not recommended, unless on Doctor's orders, although the reason is not given.

> *"Failing mother's milk cow's milk is better for the normal child than those mentioned above, (Desiccated milks, farinaceous*

pre-digested foods and farinaceous foods not pre-digested) and possess the advantage of being cheaper. No addition to milk diet is required until the child is being weaned, when bread and milk, and bread puddings may be added" (MOH Report, Cambridge, 1908: 16).

Data was collected by health visitors regarding the use of foods other than milk but the MOH reported that the figures were not large enough to prove anything with regard to their comparative effects (MOH Report, Cambridge, 1908:16).

There are major differences between human milk and cows' milk and these are critical to the growth and development of an infant. The major differences are presented in Table 9.13. A comparison is also made with modern formula milk, which is cows' milk that has been modified to fall within current government guidelines for the recommended daily nutritional requirements of infants. One of the problems with assessing the infant's nutritional needs is that human milk varies between mothers and also changes according to the age of the infant. The milk produced in the first five days is referred to as colostrum, then transitional milk is produced from day six to day ten and after day ten the milk is referred to as mature. Table 9.13 compares the major differences in the composition of mature human milk with that of cows' milk and modern formula milk.

Table 9.13: The major differences in the composition: cows', human and formula milk.

Constituent	Cows' milk	Human milk	Formula milk
Energy, kcal	66	67	65
Protein, g	3.3	1.2	1.8
Carbohydrate, g	4.8	7.0	6.9
Sodium, mg	58	15	22
Calcium, mg	125	33	48

Source: Eds. Scowen, P and Wells, (1979), *Feeding children in the First Year*, London, Edsall Table 3: 18 and Table 4: 51.

It can be seen in table 9.13 that the protein level in cows' milk is three times greater than human milk and may lead to high levels of nitrogen, which the immature infant kidney is unable to excrete. High levels of sodium also increase the solute load of the kidneys whilst an inability to excrete excess sodium results in hypernatraemia, which can lead to the death of an infant (Barnes and Roberton, 1981: 27). The cow's milk used at the milk depot was diluted and modified according to the age of the infant (MOH report, Cambridge 1910: 52). No further details are given as to this modification, but it is possible that this was similar to that used for workhouse infants.

A dietary for infants less than three years of age used in the Cambridge Union Workhouse shows that by today's standards it was deficient both in quantity and quality(Cambridge Record Office Ref: G/c/W1210). The dietary related to children less than three years of age and was mounted on thick cardboard; it had obviously been hung up, perhaps in the kitchen of the workhouse in Mill Road, Cambridge.

Table 9.14: The diet of infants under one year of age, Cambridge Union Workhouse.

Age	Interval between feeds	Number of feeds in 24 hours	Average amount per feed	Number of night feeds	Total quantity in 24 hours	Ratio of milk to water
First week	2hours	10	1 oz	2	10 ozs	1 to 2 parts
2-6 weeks	2 hours	9	1 ½ to 2ozs	2	14-18 ozs	1 to 2 parts
6wk-4mths	2 ½-3hrs	8	3 to 4 ozs	1	24-30 ozs	1 to 1 part
4-6 months	3	6	4 to6 ozs	None	24-36ozs	1 to 1/3part
6 mths-1 yr.	3 ½ hours	5 to 6	6 to 8 ozs	None	36-40 ozs	Milk only

Fruit, Glaxo, Virol, Groats etc as and when required.

Source: Dietary for infants under the age of three years, 24 May 1922, Cambridge Union Workhouse. Poor Law institutions order 1913. Available at Cambridge Record Office Ref: G/c/W1210

Table 9.14 gives details of the diet recommended for infants on the dietary under 1 year of age. The quantity of fluid is below that recommended for infants in the twenty first century, as Table 9.15 makes clear. In fact, the amount given to workhouse infants, less than six months of age in a 24 hour period fell substantially below what is currently recommended. It should also be noted that the milk given to workhouse infants was modified by the addition of water, thus reducing the nutritional value of the feed even more.

Table 9.15: Quantity of feed given to workhouse infants per day: a comparison with current recommendations.

Age	1913	1979
Week	10oz	2.5 oz per lb.
2-4 wk.	14-18oz	2.5 oz per lb.
1-3mth	24-30oz	2.5 oz per lb.
4-6mth	24-30oz	32.4 oz
6mth+	24-36oz	32.5 oz

Source: Dietary for infants under the age of three years, 24 May 1922, Cambridge Union Workhouse. Located in Cambridge Record Office. **: Eds. Scowen, P and Wells, (1979), *Feeding children in the First Year,* London, Edsall: 49.**

On the other hand this dilution may well have helped to reduce the solute load on the kidneys. Evidence suggests that infants born into poor families did not fare as well as those born and reared in the workhouse. The concept of less eligibility[3] did not apply to infants and children in the workhouse. Therefore it is likely that the dietary they were given would have been considered satisfactory (Johnston, 1985). Given this it seems

[3] According to this principle, conditions in the workhouse were to be no better than those experienced by the lowest paid worker outside.

likely that bottle-feeding amongst poor families could result in marasmus[4] and protein-calorie deficiency. This has been reported in third world countries when modern formula milk has been over diluted, particularly in the case of the three to four month old infant when associated disorders have included diarrhoea, infectious disease and brain damage (Rowe, J. 1982). So although the milk depot provided a purer and more satisfactory dietary balance than was likely to be provided by poor families themselves, by today's standards the diet was lacking in essential nutrients. What is apparent from the feeding regime after six months is that the infant's diet lacked iron. Iron has a protective function against infection. After six months of age the iron stores with which the infant is born are exhausted and iron becomes a more necessary mineral in the diet. Cows' milk contains small quantities of iron, which, unlike that in breast milk, are not readily taken up by the infant.

The evidence shows that breast-feeding was best and that the purity of cow's milk had an effect on reducing infant mortality from diarrhoea. It is suggested that it seems likely that the nutritional value of the milk

[4] Marasmus is one component of protein-energy malnutrition. It is a severe form of malnutrition caused by inadequate intake of protein and calories resulting in wasting and growth retardation (www.faqs.org/nutrition).

given to infants was unsatisfactory. It would be useful to have this investigated further.

Conclusion

This investigation has been dependent on archival material, which reported on groups, rather than on *individuals*, and this has limited the extent to which the impact of health visiting activity on the health of infants in Cambridge can be assessed. Also the MOH reports on methods of infant feeding provided a *snapshot in time* rather than a report on methods of feeding *over time*. Had this been available it would have enhanced the investigation. As a result of this, conclusions drawn from the evidence available are largely suggestive rather than proven. The evidence does however, show, "*what health visitors did*", and through this suggests how they may have influenced the health of infants in Cambridge.

The proposition was that in Cambridge the life chances of an infant could be improved by the activity of health visiting. The framework for the investigation was based on the work of historians and the modern principles of health visiting. Historians disagree on the extent of the influence exercised by health visitors on mothers in the early twentieth century. The disagreement hinges on two main points, that health visitors did not visit all the population and that the health education message was not well received.

It was expected that the evidence would show that in Cambridge a universal service was not provided by health visitors and that their visiting was restricted to families living in Barnwell and Castle End districts. In fact the evidence showed that they visited a wider area than this and that health visitors met with 85 to 90 percent of all mothers in Cambridge at least once, with many receiving further visits. In Cambridge, then, although health visiting was not a fully universal service the vast majority of mothers were in receipt of it.

Judging whether the information given by the health visitors was well received is hard to measure. Clapham reported that health visitors were 'ultimately' able to 'establish friendly relations' in all cases (1948: 3). How long it took to establish this relationship is not recorded and since the health visitors only visited families where they were required and welcome it is not surprising that a friendly relationship was established. It is known that between 85% and 90% of mothers were visited (Table 9.2) and many of these were visited on more than one occasion (Table

9.3). Although friendly relations were ultimately established this did not necessarily lead to the family taking advice offered. If a criterion for being well received is that changes in feeding practice took place, then in many households changes appear to have been made but not necessarily on the advice of the health visitor (Table 9.5). Of those not visited between 2.5% and 4.5% of infants died leaving between 9.1% and 15.3% of infants who were alive but not visited by the health visitor (Table 9.1). The reason for this is not recorded and we do not know whether the health visitors were not required or not welcome.

If the evidence is considered in the light of the two points of disagreement between historians, then the argument that health visiting cannot be effective because it was not a universal service does not hold true in the case of Cambridge. On the second point, that even those in receipt of the service did not welcome the advice, the evidence *suggests* that this might not hold true for Cambridge. There is no proof; the evidence is only suggestive, that the advice given by the health visitors was well received and acted on.

The effectiveness of the health visiting practice has been assessed using the criteria adopted by Mooney in his investigation into health visiting in

London. When compared with the London health visitors, those in Cambridge appear to have had more time to spend on each visit and made more re visits. It was only in the case of training where they fared less well than their London counterparts, but the service in Cambridge was based on a different model requiring different skills and knowledge to that of the London health visitors.

Although it could not be proven conclusively, the evidence suggested that Cambridge health visitors helped bring about a change in feeding practices by promoting both breast feeding and safer artificial feeding practices, the role of the midwife in the establishment of breast feeding - although not explored here - also contributed to the numbers of women breast feeding. Increases in the number of mothers breast feeding and those adopting safe artificial feeding practices would have contributed to the fall in infant mortality. However, safer artificial feeding practices could not be solely attributed to health visiting activity, because, as was suggested above, the opening of the milk bank influenced the decline in usage of the long tube. The evidence shows that health visitors were not alone in promoting breast feeding and safer methods of bottle feeding therefore they alone cannot be held responsible for improving the health of infants. The evidence presented above showed breast feeding provided protection against diarrhoeal disease (Table 9.10a) and that breast fed infants were more likely to survive to one year of age (Table 9.9). A comparison of the composition of cow's milk with that of human milk showed that cow's milk was high in protein and sodium which could lead to excretion problems and ultimately to infant death. Although milk depot cow's milk was modified for infants there is no information to what extent and how appropriate it was for infant use. The dietary used at the workhouse was shown to be below that which is currently recommended (Tables 9.14 and 9.15). There is no evidence to show how mothers in Cambridge modified cow's milk for use with infants. Therefore it was suggested that the nutritional value of milk given to infants was likely to have been unsatisfactory.

So far using various measures the evidence suggests that health visiting activity, whilst not solely responsible for the decline in infant mortality in Cambridge, certainly played a part. But using the modern principles of health visiting how effective was health visiting in these early years? The evidence presented so far can be considered in respect of the four principles, as set out below.

Search for health needs - working in partnership with clients, data collection and analysis, use of empirical evidence.

There is no evidence to show that the health visitor and the mother worked in partnership when making decisions about the infant's care, but the first report of the LPEI did state that the health visitors did establish friendly relations with the mothers (First Annual Report of the LPEI, 1907). The method of feeding statistics show that health visitors were involved in data collection but it was the MOH who reported on these, and that he did link these statistics to infant mortality and in particular infant mortality in relation to diarrhoea. The value of the data is lessened because it only refers to one point in time.

Stimulation of awareness of health needs - raising awareness of health needs.

The health visitors distributed information about the prevention of diarrhoea (Figure 9.1). This included information about the necessity to adopt good hygiene within the home and its environs. In chapter 8 it was reported that occupants had cleansed the walls of their homes, papered and whitewashed rooms and cleaned up backyards. The health visitors had also raised, with the Medical Officer of Health, the need for landlords to make satisfactory improvements to 46 houses.

Influencing policies affecting health - acting as a pressure group.

By reporting to the MOH on the sanitary conditions of houses, which only the landlord could change, the health visitor could be said to be acting as an advocate. It could be argued that this was a first stage in influencing policy to bring about change.

Facilitation of health enhancing activities - promotion of breast feeding and teaching safe feeding practices

It is to this area that most of the work of the health visitors was directed. It has already been stated that the infant feeding findings should be treated cautiously because they were based on a snapshot in time rather than change over time. It was suggested that in the case of second or third time mothers that health visitors may have influenced feeding practice over time but that there was no hard evidence to show this.

The aim in presenting this evidence was to determine the part played by Cambridge health visitors in the decline of infant mortality. As the findings needed to be approached with caution it can only be concluded that the evidence is suggestive of health visitors' involvement, along with others, in a change in feeding patterns. Method of infant feeding was one of the factors which contributed to a decline in infant mortality. What has been shown is that the majority of women received at least one visit from a health visitor and that the health visitors targeted around 2% of the families for further intensive visiting. Health visiting in England differed from one town or city to the next and therefore not being effective in one place does not preclude effectiveness in another, this could account for disagreement between historians.

Chapter 10 - Discussion of findings

This thesis aimed to examine two propositions. These have been chosen because the author currently works as a health visitor and set out to investigate the role of health visiting in the early twentieth century in relation to infant health. Environmental and personal characteristics play a part in the prevention and promotion of health in the twenty first century and therefore these characteristics have been used to evaluate the relative importance of these to the decline in infant mortality.

The first proposition is, that the chance of infant survival was determined more by environmental characteristics than by personal and family characteristics. The second proposition is that, after 1906 when health visiting was established in Cambridge, the development of a one-to-one relationship between health visitors and the mothers of newborn children was a major contributor to the decline of infant mortality. The findings will be discussed in relation to the propositions but initially an overview of the findings of the decline in infant mortality is discussed.

Infant mortality decline in Cambridge 1871 - 1911

Drawing on data from the MOH reports the conventional method of calculating the IMR was used. From 1905 onwards the Vaccination Birth

Registers allowed a more detailed picture of infant mortality, albeit only prior to the vaccination of the infant or death if it occurred prior to vaccination. The first health visitors were employed in Cambridge in 1906 and this coincides with the period when the Vaccination birth Registers are available.

In Cambridge, in 1871 there were 150 infant deaths per 1000 live births whilst in 1910 there were 74. Infant mortality declined below 100 for the first time in 1904 but rose, as result of deaths due to infantile diarrhoea, in the years 1905, 1906 and 1911. It also rose in 1908 as a result of an outbreak of both whooping cough and measles; environmental factors influencing the spread of infectious disease are discussed below. The general trend of the decline in Cambridge was similar to that for England and Wales as a whole, but from 1881 onwards it fell below the national average.

There were two sub-registration districts in Cambridge, St. Andrew the Great and St. Andrew the Less. Despite considerable fluctuation in the IMR over the years St. Andrew the Great sub-registration district was the healthiest place for an infant to live in the period 1876-1911 (Chapter 2). Even within this district the parish of St. Giles was relatively unhealthy place for infants to live. The MOH identified that infant mortality from diarrhoeal disease was greater in some parts of the town than in others, namely Barnwell to the east of the town and Castle End (St. Giles parish) to the north. Although socially these two areas were comparable infant mortality from diarrhoea was far greater in Barnwell than in Castle End (MOH report 1880: 5-9). The only difference between the two districts was that the sewer gradient in Castle End was very steep whilst that in Barnwell was slight leading to stagnant and slow moving sewage. At the time the MOH argued that gasses produced as a result of fermentation in the stagnant sewage were forced upwards through faulty traps in scullery sinks leading to infection (MOH report, 1880: 7-9). A more likely explanation was that a cracked sewer pipe had polluted the soil and eighteen years later Dr. Anningson noted a relationship between persistent high temperature, polluted soil and infant diarrhoea in parts of Barnwell (MOH report 1898: 13). Flies landing on the polluted soil, rotting vegetable matter or animal manure acted as a vector in the spread of disease (Morgan, 2001). The flies then contaminated milk used for feeding infants, in the home milk was frequently stored in unsatisfactory conditions conducive to the multiplication of germs (MOH report, 1911). Infant feeding equipment was also responsible for the spread of diarrhoea, particularly the long tube used in the flask shaped bottle this considered to be impossible to cleanse. When contaminated milk was drawn through the tube any germs in the milk flourished undisturbed inside the tube (MOH report 1908:17). Table 9.10a showed that the percentage of infants dying from diarrhoea was much greater in bottle fed infants than in those that were breast fed, or partially breast (see Chapter 9). Although water is known, where infected with bacteria, to spread infant mortality there was no evidence to show this was the case in Cambridge. The environmental characteristics contributing to the spread of diarrhoea and other infectious diseases are further discussed below as is the educative role of health visitors aimed at improving breast feeding rates or promoting safer bottle feeding techniques.

Like infant diarrhoea respiratory diseases of bronchitis and pneumonia showed a seasonal aspect. These diseases were more likely to occur in the winter months. Craig stated that excessively hot and dry years brought many cases of diarrhoeal illness and that damp cool years led to respiratory disease (Craig, 1995: 23). The seasonal aspect of these diseases was an environmental characteristic which had an impact on the IMR and largely the IMR peaked in the summer months when diarrhoea cases were higher than usual and a peak was also demonstrated in the winter months when cases on bronchitis and pneumonia were higher but this was not consistently so suggesting that other factors were important in the case of infant survival.

Personal and family characteristics included the occupation of head of household. Choice as to where a family lived was constrained by family income which was related to occupation. Analysis of the 1905 Vaccination Birth Registers confirmed that the occupational structure of families where there was a newborn infant was similar to the population as a whole and the predominant male occupations fell into seven categories.

1. Unskilled - labourers
2. Retail - grocer, butcher, baker
3. Building trade - carpenter, painter, bricklayer
4. Production of goods - tailor, blacksmith, compositor
5. Railway - porter, fireman
6. Service - policeman
7. Clerical

Data from the Vaccination Birth Registers showed that the healthiest infants were born into families headed by railway employees, printing workers and professionals. The unhealthiest infants were those born into families headed by a labourer or a mother on her own. Occupation and income then are factors which influence the health of an infant. This is further discussed below in relation to housing and place of residence.

Other personal characteristics which disadvantaged infants included gender, male infants were less likely to survive than female infants. Twin or multiple births did not have a chance of survival as great as that of their singleton born peers. Infant births where the mother was recorded as head of household in the Vaccination Birth Register were, for the purpose of this investigation taken to be illegitimate. Where a mother was on her own, for instance when her husband was deceased, his occupation prior to death was recorded. We found that in Cambridge illegitimacy disadvantaged infants, including in the neonatal period which was unlike the findings of other researchers. Reid found that illegitimacy was a major influence on post neonatal and child mortality (Reid, 1999 & 2001). She confirmed previous work that suggested that neonatal disadvantage was not significant (Wrigley 1977). Craig made a comparison of the causes of infant death for illegitimate and legitimate infants over the period 1908-1913 and found that legitimate born infants were more likely to experience death due to a premature birth whilst illegitimate infants were more likely to die as a result of debility. She found that illegitimate infants made up five percent of the birth cohort but eight percent of the death cohort. In Cambridge, in the period 1905-1911 the risk of death in the first month of life for a twin was 9.8 times greater than that for a singleton birth (see Chapter 4). Reid, who was dealing with a cohort more than five times greater than the Cambridge one, found that the risk was more than eight times greater (Reid, 2001).

In this brief overview of infant mortality in Cambridge during the period 1875-1911 both environmental and personal/family characteristics have been identified as contributing to the mortality of infants. The relative importance of those characteristics in relation to the infant mortality will now be discussed.

Is the chance of survival determined more by environmental characteristics or by personal and family characteristics?

The knowledge about the transmission route of the disease is useful when evaluating the relative importance of environmental characteristics versus personal/family characteristics. The cause of death for individuals is not known but we do know how many infants died from a given cause, when they died and in what sub-registration district of Cambridge. Findings related to cause of death should be approached cautiously for two reasons. Firstly the medical practitioner frequently diagnosed death from reported symptoms having never seen the patient in his final illness. Secondly the symptoms were often given as cause of death rather than the actual disease which led to death. Because this information is at community level the caution around accuracy of diagnosis of individual cases is not of such great concern, although when looking at numbers of cases this caution is still pertinent. The MOH gave the main causes of infant death as diarrhoea, bronchitis, pneumonia, premature birth, debility, measles and whooping cough.

The prevalence of infant diarrhoea was discussed above and it was shown that atmospheric conditions and a faulty sewer line (environmental characteristics) were contributory factors in the spread of the disease but feeding practices (family Characteristic) also played a part. The major environmental improvement in Cambridge in the nineteenth century was the completion of the sewerage system. Dr. Dalton Chairman of the Public Health Committee, in response to sceptics who felt the £100,000 cost of the new system was of doubtful value to the town, argued that the health of townspeople had improved but how much was down to the sewerage system and how much to other sanitary measures he considered was debatable (Dalton, 1909: 15). Our research confirmed Dr. Dalton's opinion that although diarrhoea deaths peaked in 1893 outbreaks did occur after the installation of a new sewerage system in Cambridge suggesting that other environmental factors were implicated in the transmission of bacteria and viruses that led to diarrhoeal diseases. We have discussed the transmission route of diarrhoeal disease and the factors involved in that transmission. The cycle of transmission can be broken by changes to the environmental characteristics. The new sewerage scheme had such an impact and changes to other environmental factors in the early years of the twentieth century were regular removal of refuse and changes in feeding practices advocated by health visitors.

The geography of the prevalence of infantile diarrhoea was discussed above and it was noted that parts of the town were less healthy than others this was as a result of rapid growth in housing after the 1807 Enclosure Award released land for building and changes the face of Cambridge (Chapter 3:107). The population of Cambridge, increased rapidly between 1801 and 1911 (Table 3.1) this led to St. Andrew the Less being five times greater in population size than St. Andrew the Great (Chapter 3). The growth was not distributed evenly over time or space and the houses were crowded into many of the courts and yards in the older parts of the town, for instance St. Giles. As the town expanded beyond its medieval limits the village of Barnwell became part of Cambridge and led to the residents way of life to be adversely affected.

The Vaccination Birth Registers for these two areas, St. Giles and Barnwell, allowed investigation a street level for the first three months of life. Fourteen streets in St. Andrew the Less, including Barnwell, were investigated in detail. It was found that some streets were indeed healthier than others and that the state of housing played a part in this difference. Both Cayley and Jebb were concerned with environmental conditions in the town. Cayley found that in some parishes there was a greater percentage of housing with a rent of less than six shillings each week i.e. the parish of St. Matthew. The state of that housing also differed from parish to parish. Although housing and the facilities within and around the house are environmental factors which have an influence of infant mortality choice as to which home a family lives in is constrained by family income, a family characteristic.

The Vaccination Birth Registers were used to compare occupational group and rateable value (RV) of property (Table 4.5). This confirmed that professional families were more likely to live in high RV property, whilst labourers were more likely to occupy lower RV property. An investigation at street level suggested that this was not always the case because there were families who carried out their trade and lived in their place of work, the rateable value for these properties were higher than purely residential houses. What this investigation did show was that infants born in the more recently developed parts of the town, in particular the parish of St. Philip (Romsey Town) were healthier than those who lived in the cramped conditions of St. Andrew the Less (Barnwell), the first area of Cambridge to experience development in the early nineteenth century.

The growth in population led, in some instances to overcrowding and it was in these conditions that the spread of diarrhoea, measles, whooping cough and tuberculosis increased. These diseases are transmitted by droplet and airborne infection (Chapter 5). Detailed investigation was carried out in the five year period 1906-1910 and in that period there were infant deaths from measles and whooping cough. As no individual cause of death data was available then we were not able to determine whether or not overcrowding was a factor in the 30 deaths in this period. Environmental factors, then, are important in the spread of infectious diseases but from the data available this cannot be proven to be a contributory factor in infant deaths from infections in Cambridge in 1906-1910.

The MOH reported that almost a half (46.8%) of infants dying in Cambridge in the first year of life in the period 1906-1910 died during the first eight weeks of life. The majority of these deaths occurred in the first week of life with the most likely cause of death assigned to the category wasting disease. This included premature birth, congenital defects, injury at birth, lack of breast milk, atrophy, debility and marasmus. These conditions can be said to be the result of personal characteristics although to some extent environmental characteristics could be implicated before the infant was delivered. In Cambridge we hypothesised that the additional smoke from trains could have impacted on the foetus as it was exposed, via the mother, to a high amount of carbon monoxide.

The social model of health recognises that health, including the health of an infant, is affected by all factors impacting on the lives of people living within a community and this includes the social environment, or how people live and work together. University members and residents of the town played a part in reducing the IMR by becoming involved in philanthropic activity and the development of infant welfare services. In March 1906 the Cambridge Branch of the National League for Physical Education and Improvement (LPEI) was established and it was here that the elite from the University met the town elite. A theme running through the thesis has been that of how individuals and groups in Cambridge acted as drivers for change leading to an improvement in the health of infants. These ranged from professionals like Dr. Anningson pushing repeatedly for an improvement in the sewage system, to Prof. Howard Marsh instigating the development of the Cambridge branch of the LPEI. Action was also communal in nature, witness the activities of the team led by Cayley which gathered the evidence used to pressure for improvements to the housing of the poor. Jebb was one of Cayley's team who visited the homes of the poor to record the details on the state of housing. Therefore she was privy to the conditions in which the poor of the town existed. It was likely that many of her fellow committee members on the executive committee of the LPEI had no real idea, of how, and under what conditions the poor lived. The LPEI were responsible for establishing several infant welfare initiatives and in particular the health visiting service.

So were environmental characteristics or personal and family characteristics more important in the infants chance of survival to the first year of life? From this evidence it has been shown that both are important as are social characteristics. In the period under investigation changes had been brought about in Cambridge to both environmental (sewage management, refuse removal and pure water) and social characteristics (the activity of the University and town elites in developing infant welfare initiatives). These positively influenced infant mortality, whereas personal characteristics remained unchanged. Despite the number of infants dying as a result of 'failure to thrive' decreasing those related to premature birth increased. Since housing straddles environmental and family characteristics this may be the deciding factor in answering the question are environmental factors more important than personal or family characteristics? From the evidence presented in this thesis it would seem that environmental characteristics were more important but further research at street level on the influence of family income might swing the decision in the favour of family characteristics. In Cambridge, unlike other researchers, we found that illegitimate infants were disadvantaged in the neonatal period. Further investigation should be carried out to determine an explanation for this difference. We also found that mortality from diarrhoea was more likely to occur before four months of age; again this was the opposite to the findings of other researchers. This also requires further investigation

Did the health visiting service contribute to the decline in infant mortality?

The health visiting service was established by the LPEI in 1906 who investigated several models of health visiting that had been developed in other towns before deciding on the model that would be adopted in Cambridge. The salary of the health visitors was contributed by local business men and rather than working directly under the MOH the health visitors were supervised by qualified nurses who worked in a voluntary capacity. The LPEI had obviously considered the findings and developed a model that fitted the Cambridge situation. Local businessmen belonging to the LPEI rather than a public agency funded the health visitor posts, the Hon. Secretary of the LPEI; Mrs. Howard Marsh was a qualified nurse and together with another qualified nurse supervised the work of the health visitors, on a voluntary basis. Health visiting, then, was an example of co-operative working between the members of the University and the townspeople. The public agencies were not completely sidelined because statistical information was reported to the MOH who also decided on the content of the information to be shared with the parents. The influence of members of the LPEI both those from the University and those from the town played an important part in improving infant health in Cambridge after 1906.

The part played by health visitors will now be discussed. In the early nineteenth century contemporary writers were keen to put the decrease in infant mortality at the feet of the health visitors but it seems that no one had taken into account the part played by midwives in the establishment of breast feeding. In Cambridge we found that prior to the adoption of the Notification of Births Act mothers did not have contact with a health visitor until the infant was four weeks old, or older. Even after the adoption of this Act the earliest the health visitor made contact was at 10 days and then only if the midwife had discharged the mother. The midwives in Cambridge were professionally qualified women and it is suggested that they were in a position to influence the mother about breast feeding rather than the health visitor. It is suggested that more research should be carried out on the role of midwives in the establishment of breast feeding. The role of the health visitor was in the maintenance of breast feeding and in the case of artificially fed infants promoting safe feeding practices. Craig in her work concluded that the there were many factors involved in bringing about the decline in infant mortality including initiatives such as health visiting

Nationally the health visiting service was by no means universally provided in the first decade of the twentieth century and this is the reason historians argue that any decline in infant mortality cannot be attributed to health visiting. (Lewis, 1980; Mooney, 1994). In Cambridge we found from the evidence in the MOH reports that although the service was not universally provided following the birth of a baby a health visitor visited between 85% and 90% of mothers. Dyhouse argues that however sound the advice given if it was offered in a condescending and patronising way then it would not be well received (Dyhouse, 1978). Dwork on the other hand argues that there is evidence that in some cases advice was well received. and that it did make 'a unique and lasting contribution to welfare work' (Dwork, 1987: 69). From the MOH reports it is known that, in Cambridge, health visitors only visited the mothers who welcomed a visit. Whether or not the choice was extended to all mothers is not stated. It seems likely that a choice was available to those mothers with a higher social standing rather than the majority of Cambridge mothers, who did not fall into this group. Lady Clapham in her final report on the work of the Maternal and child Welfare service in Cambridge stated that 'health visitors were, if not at first, finally welcomed by the mothers they visited' (Clapham, 1948). This statement suggests that the majority of mothers had no choice but to receive a visit from a health visitor but it does claim that the health visitors were, finally, accepted by Cambridge mothers.

The effectiveness of the health visiting practice was assessed using the criteria adopted by Mooney in his investigation into health visiting in London. Of the three criteria (the proportion of births visited; the number of revisits and the extent of training), it was only as regards the last mentioned that the Cambridge health visitors fared less well than their London health counterparts. However, given that the model of health visiting in Cambridge was different from that in London then the Cambridge health visitors were not required to have professional training. Despite the lack of formal training the health visitors were given guidance on matters of infant care by the lady supervisors (who were trained nurses) and the lack of formal training did not make them any less effective, as evidenced by the reports on their activity.

The way in which an infant was fed has been shown to be the single most important factor affecting infant mortality (Fildes, 1998). Exclusive breast feeding up to the age of four months has been associated with a health gain in infancy (Howie *et al,* 1990). A major cause of infant death was found to be the result of an infant failing to thrive which put feeding high on the agenda of those concerned with infant welfare. The health visitors were directed to encourage safe bottle feeding practices if breast feeding failed and the milk depot meant that mothers could purchase pure milk for a reduced rate. In Cambridge after 1906 changes in feeding practice did occur but safer feeding practices could not solely be down to the activity of health visiting, other initiatives of the LPEI namely the milk bank and infant consultation centre also played a part. The increase in numbers breast feeding probably had an effect not only in reducing the number of deaths from diarrhoea but also from respiratory disease and infectious childhood diseases. So health visitors made an impact on the health of an infant by influencing the care provided by the mother.

Cambridge health visitors were not solely concerned with infant feeding practices they also encouraged families to improve the cleanliness of their homes and if the state of their house required the landlord to make improvements through the MOH they ensured that the condition of housing was improved. This aspect of their work impacted on the health of the infant by improving the environment where an infant lived.

In summary then, did health visitors play a part in the decline in infant mortality? When considering this question it is necessary to take into account the part played by others, in particular the work related to the

LPEI. The members of the LPEI were critical to the establishment of not only health visiting but the other services which improved infant health, the milk bank, the mother's school and the infant consultation centres. As discussed above the theme that emerged was that individuals were drivers for change and both Cayley and Jebb played a significant part in brining about change including the establishment of and the work of health visitors. If the work of all these are considered then health visiting did contribute to an improvement in the health of infants but the evidence is only *suggestive* that health visitors did have an impact on the infant mortality rate.

We have identified that Cambridge health visitors had more time to spend with the mothers and that they carried out targeting of mothers most in need of their services. It was not until after the Notification of Births Act that the health visitors were in the position to make early contact with mothers and thereby influence feeding practices. Investigation into their work over a longer time span, when these changes had been brought in may provide more evidence to the part they played in infant health. Alongside this it is suggested that the role of the midwife in relation to infant feeding should be investigated.

Appendices

Appendix 1: Life tables Cambridge and sub-registration districts 1905-11
The data used is drawn from the Vaccination Birth Registers, see Chapter 4.

Appendix 2: Life tables for males and those for females, Cambridge and sub-registration districts 1905-11. See Chapter 4

Appendix 3: This gives details from which Table 7.2 in Chapter 7 is drawn

Appendix 1: Life Tables Cambridge 1905-1911

Life Table for St. Andrew the Less, Cambridge 1905-11										
	Births	4857								
						Life-Table				
	Losses			Gains		Mortality		Survivors	Deaths	Cum. Deaths
[1]	[2]	[3]	[4]	[5]	[6]	[7]		[8]	[9]	[10]
Age in days	Deaths	Vaccinated	Went Out	Came In	At Risk	nqx	q(x)	l(x)	d(x)	cum d(x)
<30	139	40	90	0	4857	0.0286	0.0286	1000	29	28.6
<60	73	189	0	0	4588	0.0159	0.0445	971	15	44.1
<90	37	346	0	0	4326	0.0086	0.0531	956	8	52.3
<120	41	418	0	0	3943	0.0104	0.0635	948	10	62.1
<150	19	1030	0	0	3484	0.0055	0.0689	938	5	67.2
<180	14	288	0	0	2435	0.0057	0.0747	933	5	72.6
<210	13	114	0	0	2133	0.0061	0.0808	927	6	78.2
<240	4	64	0	0	2006	0.0020	0.0828	922	2	80.1
<270	8	37	0	0	1938	0.0041	0.0869	920	4	83.9
<300	9	21	0	0	1893	0.0048	0.0917	916	4	88.2
<330	16	18	0	0	1863	0.0086	0.1002	912	8	96.1
<365	6	22	0	0	1829	0.0033	0.1035	904	3	99.0
					1801	0.0000	0.1035	901	0	99.0
Total	379	2587	90	0						
Aggregate-Based						Individual-Based				
Infant Mort	78.0					Infant Mortality		99.0		

Life Table for St. Andrew the Great, Cambridge 1905-1911										
	Births	831								
						Life-Table				
	Losses			Gains		Mortality		Survivors	Deaths	Cum. Deaths
[1]	[2]	[3]	[4]	[5]	[6]	[7]		[8]	[9]	[10]
Age in days	Deaths	Vaccinated	Went Out	Came In	At Risk	nqx	q(x)	l(x)	d(x)	cum d(x)
<30	31	12	22	0	831	0.0373	0.0373	1000	37	37.3
<60	9	44	0	0	766	0.0117	0.0491	963	11	48.6
<90	6	76	0	0	713	0.0084	0.0575	951	8	56.6
<120	4	100	0	0	631	0.0063	0.0638	943	6	62.6
<150	4	169	0	0	527	0.0076	0.0714	937	7	69.7
<180	0	92	0	0	354	0.0000	0.0714	930	0	69.7
<210	1	33	0	0	262	0.0038	0.0752	674	4	73.3
<240	2	28	0	0	228	0.0088	0.0840	927	8	81.4
<270	0	8	0	0	197	0.0000	0.0840	919	0	81.4
<300	1	10	0	0	189	0.0053	0.0893	919	5	86.3
<330	0	6	0	0	178	0.0000	0.0893	914	0	86.3
<365	2	11	0	0	172	0.0116	0.1009	914	11	96.9
					159	0.0000	0.1009	903	0	96.9
Total	60	590	22	0						
Aggregate-Based						Individual-Based				
Infant Mort	72.2					Infant Mortality		96.9		

Life Table for Cambridge 1905 -1911										
	Births	5688								
						Life-Table				
	Losses			Gains		Mortality		Survivors	Deaths	Cum. Deaths
[1]	[2]	[3]	[4]	[5]	[6]	[7]		[8]	[9]	[10]
Age in days	Deaths	Vaccinated	Went Out	Came In	At Risk	nqx	q(x)	l(x)	d(x)	cum d(x)
<30	170	52	112	0	5688	0.0299	0.0299	1000	30	29.9
<60	82	233	0	0	5354	0.0153	0.0452	970	15	44.7
<90	43	422	0	0	0	0.0085	0.0537	955	8	52.9
<120	45	518	0	0	4574	0.0098	0.0636	947	9	62.2
<150	23	1199	0	0	4011	0.0057	0.0693	938	5	67.6
<180	14	380	0	0	2789	0.0050	0.0743	932	5	72.3
<210	14	147	0	0	2395	0.0058	0.0802	928	5	77.7
<240	6	93	0	0	2234	0.0027	0.0829	922	2	80.2
<270	8	45	0	0	2135	0.0037	0.0866	920	3	83.6
<300	10	31	0	0	2082	0.0048	0.0914	916	4	88.0
<330	16	24	0	0	2041	0.0078	0.0992	912	7	95.2
<365	8	33	0	0	2001	0.0040	0.1032	905	4	98.8
					1960	0.0000	0.1032	901	0	98.8
Total	439	3177	112	0						
Aggregate-Based						Individual-Based				
Infant Mort	77.2					Infant Mortality		98.8		

Source data: Cambridge Vaccination Birth Registers 1905-1912

Appendix 2: Life tables for male and female infants, Cambridge 1905-1911

Life Table for male infants St. Andrew the Less, Cambridge 1905-11										
	Births	2499								
						Life-Table				
	Losses			Gains		Mortality		Survivors	Deaths	Cum. Deaths
[1]	[2]	[3]	[4]	[5]	[6]	[7]		[8]	[9]	[10]
Age in days	Deaths	Vaccinated	Went Out	Came In	At Risk	nqx	q(x)	l(x)	d(x)	cum d(x)
<30	82	17	45	0	2499	0.0328	0.0328	1000	33	32.8
30<60	37	92		0	2355	0.0157	0.0485	967	15	48.0
60<90	24	162		0	2226	0.0108	0.0593	952	10	58.3
90<120	20	215		0	2040	0.0098	0.0691	942	9	67.5
120<150	11	520		0	1805	0.0061	0.0752	932	6	73.2
150<180	4	138		0	1274	0.0031	0.0783	927	3	76.1
180<210	9	58		0	1132	0.0080	0.0863	924	7	83.4
210<240	2	36		0	1065	0.0019	0.0882	917	2	85.2
240<270	6	19		0	1027	0.0058	0.0940	915	5	90.5
270<300	6	12		0	1002	0.0060	0.1000	909	5	96.0
300<330	2	10		0	984	0.0020	0.1020	904	2	97.8
330<364	7	14		0	972	0.0072	0.1092	902	6	104.3
>365					951	0.0000	0.1092	896	0	104.3
Total	210	1293	45	0						
Aggregate-Based						Individual-Based				
Infant Mort	84.0					Infant Mortality		104.3		

Life Table for male infants St. Andrew the Great, Cambridge 1905-11										
	Births	434								
						Life-Table				
	Losses			Gains		Mortality		Survivors	Deaths	Cum. Deaths
[1]	[2]	[3]	[4]	[5]	[6]	[7]		[8]	[9]	[10]
Age in days	Deaths	Vaccinated	Went Out	Came In	At Risk	nqx	q(x)	l(x)	d(x)	cum d(x)
<30	20	7	10	0	434	0.0461	0.0461	1000	46	46.1
30<60	6	21		0	397	0.0151	0.0612	954	14	60.5
60<90	4	46		0	370	0.0108	0.0720	940	10	70.7
90<120	2	59		0	320	0.0063	0.0783	929	6	76.5
120<150	3	75		0	259	0.0116	0.0898	924	11	87.2
150<180	0	42		0	181	0.0000	0.0898	913	0	87.2
180<210	0	22		0	139	0.0000	0.0898	913	0	87.2
210<240	1	14		0	117	0.0085	0.0984	913	8	95.0
240<270	0	8		0	102	0.0000	0.0984	905	0	95.0
270<300	0	6		0	94	0.0000	0.0984	905	0	95.0
300<330	1	2		0	88	0.0114	0.1098	905	10	105.2
330<364		4		0	85	0.0000	0.1098	895	0	105.2
>365		0			81	0.0000	0.1098	895	0	105.2
Total	37	306	10	0						
Aggregate-Based						Individual-Based				
Infant Mort	85.3					Infant Mortality		105.2		

Life Table for male infants, Cambridge 1905-11										
	Births	2933								
						Life-Table				
	Losses			Gains		Mortality		Survivors	Deaths	Cum. Deaths
[1]	[2]	[3]	[4]	[5]	[6]	[7]		[8]	[9]	[10]
Age in days	Deaths	Vaccinated	Went Out	Came In	At Risk	nqx	q(x)	l(x)	d(x)	cum d(x)
<30	102	24	55	0	2933	0.0348	0.0348	1000	35	34.8
30<60	43	113		0	2752	0.0156	0.0504	965	15	49.9
60<90	28	208		0	2596	0.0108	0.0612	950	10	60.1
90<120	22	275		0	2360	0.0093	0.0705	940	9	68.9
120<150	15	594		0	2063	0.0073	0.0778	931	7	75.6
150<180	4	180		0	1454	0.0028	0.0805	924	3	78.2
180<210	9	80		0	1270	0.0071	0.0876	922	7	84.7
210<240	3	50		0	1181	0.0025	0.0902	915	2	87.0
240<270	5	27		0	1128	0.0044	0.0946	913	4	91.1
270<300	6	18		0	1096	0.0055	0.1001	909	5	96.1
300<330	4	12		0	1072	0.0037	0.1038	904	3	99.4
330<364	6	18		0	1056	0.0057	0.1095	901	5	104.6
>365		2			1032	0.0000	0.1095	895	0	104.6
Total	247	1599	55	0						
Aggregate-Based						Individual-Based				
Infant Mort	84.2					Infant Mortality		104.6		

Source data: Cambridge Vaccination Birth Registers 1905-1912

Appendix 2: Life tables for male and female infants, Cambridge 1905-1911

Life Table for female infants St. Andrew the Less, Cambridge 1905-11										
	Births	2358								
						Life-Table				
	Losses			Gains		Mortality		Survivors	Deaths	Cum. Deaths
[1]	[2]	[3]	[4]	[5]	[6]	[7]		[8]	[9]	[10]
Age in days	Deaths	Vaccinated	Went Out	Came In	At Risk	nqx	q(x0	l(x)	d(x)	cum d(x)
<30	57	21	45	0	2358	0.0242	0.0242	1000	24	24.2
30<60	36	99		0	2235	0.0161	0.0403	976	16	39.9
60<90	13	184		0	2100	0.0062	0.0465	960	6	45.8
90<120	21	203		0	1903	0.0110	0.0575	954	11	56.4
120<150	8	507		0	1679	0.0048	0.0623	944	4	60.9
150<180	9	153		0	1164	0.0077	0.0700	939	7	68.1
180<210	5	55		0	1002	0.0050	0.0750	932	5	72.8
210<240	2	29		0	942	0.0021	0.0771	927	2	74.7
240<270	2	17		0	911	0.0022	0.0793	925	2	76.8
270<300	6	10		0	892	0.0067	0.0860	923	6	83.0
300<330	4	7		0	876	0.0046	0.0906	917	4	87.2
330<364	6	9		0	865	0.0069	0.0975	913	6	93.5
>365					850	0.0000	0.0975	906	0	93.5
Total	169	1294	45	0						
Aggregate-Based						Individual-Based				
Infant Mort	71.7					Infant Mortality		93.5		

Life Table for female infants St. Andrew the Great, Cambridge 1905-11										
	Births	397								
						Life-Table				
	Losses			Gains		Mortality		Survivors	Deaths	Cum. Deaths
[1]	[2]	[3]	[4]	[5]	[6]	[7]		[8]	[9]	[10]
Age in days	Deaths	Vaccinated	Went Out	Came In	At Risk	nqx	q(x)	l(x)	d(x)	cum d(x)
<30	12	5	12	0	397	0.0302	0.0302	1000	30	30.2
30<60	2	24		0	368	0.0054	0.0357	970	5	35.5
60<90	2	48		0	342	0.0058	0.0415	965	6	41.1
90<120	2	49		0	292	0.0068	0.0484	959	7	47.7
120<150	1	74		0	241	0.0041	0.0525	952	4	51.7
150<180	0	44		0	166	0.0000	0.0525	948	0	51.7
180<210	1	12		0	122	0.0082	0.0607	948	8	59.4
210<240	1	14		0	109	0.0092	0.0699	941	9	68.1
240<270	1	5		0	94	0.0106	0.0805	932	10	78.0
270<300	0	1		0	88	0.0000	0.0805	922	0	78.0
300<330	0	4		0	87	0.0000	0.0805	922	0	78.0
330<364	1	4		0	83	0.0120	0.0926	922	11	89.1
>365					78	0.0000	0.0926	911	0	89.1
Total	23	284	12	0						
Aggregate-Based						Individual-Based				
Infant Mort	57.9					Infant Mortality		89.1		

Life Table for female infants, Cambridge 1905-11										
	Births	2755								
						Life-Table				
	Losses			Gains		Mortality		Survivors	Deaths	Cum. Deaths
[1]	[2]	[3]	[4]	[5]	[6]	[7]		[8]	[9]	[10]
Age in days	Deaths	Vaccinated	Went Out	Came In	At Risk	nqx	q(x)	l(x)	d(x)	cum d(x)
<30	69	26	57	0	2755	0.0250	0.0250	1000	25	25.0
30<60	38	124		0	2603	0.0146	0.0396	975	14	39.3
60<90	15	230		0	2441	0.0061	0.0458	961	6	45.2
90<120	24	253		0	2196	0.0109	0.0567	955	10	55.6
120<150	8	581		0	1919	0.0042	0.0609	944	4	59.6
150<180	10	197		0	1330	0.0075	0.0684	940	7	66.6
180<210	5	67		0	1123	0.0045	0.0729	933	4	70.8
210<240	3	43		0	1051	0.0029	0.0757	929	3	73.4
240<270	2	22		0	1005	0.0020	0.0777	927	2	75.3
270<300	6	11		0	981	0.0061	0.0838	925	6	80.9
300<330	3	11		0	964	0.0031	0.0869	919	3	83.8
330<364	9	13		0	950	0.0095	0.0964	916	9	92.5
>365					928	0.0000	0.0964	908	0	92.5
Total	192	1578	57	0						
Aggregate-Based						Individual-Based				
Infant Mort	69.7					Infant Mortality		92.5		

Source data: Cambridge Vaccination Birth Registers 1905-1912

Appendix 3

Cambridge 1902-3 Investigation into the state of housing of the poor

	No. houses	Defective repair	%	Defective height	%	Ranking defective repair	Ranking defective height	
St. Andrew the Less	498	81	16.3	89	17.9	6	6	
St. Matthew	528	52	9.8	34	6.4	2	3	
St. Barnabas	72	4	5.6	0	0.0	1	1	
St. Philip	377	46	12.2	12	3.2	3	2	
Holy Trinity	59	11	18.6	23	39.0	7	8	
St. Paul	252	75	29.8	57	22.6	8	7	
Small central parishes	113	15	13.3	19	16.8	4	4	
St. Giles	141	22	15.6	24	17.0	5	5	
Total	2040	306	15.0	258	12.6			
Oxford	1707	272	15.9	158	9.3			
Ranking 1=best 8=worst								

	No. houses	Size sufficient	%	% not sufficient	Ranking size not sufficient	no yard	%	Ranking no yard
St. Andrew the Less	519	391	75.3	24.7	5	24	4.6	5
St. Matthew	567	517	91.2	8.8	2	7	1.2	2
St. Barnabas	75	67	89.3	10.7	3	1	1.3	3
St. Philip	378	353	93.4	6.6	1	0	0.0	1
Holy Trinity	59	13	22.0	78.0	7	7	11.9	6
St. Paul	259	199	76.8	23.2	4	8	3.1	4
Small central parishes	125	26	20.8	79.2	8	41	32.8	8
St. Giles	186	104	55.9	44.1	6	47	25.3	7
Total	2168	1670	77.0	23.0		135	6.2	
Ranking 1=best 8=worst								

Source: Cayley, H. (1904) The housing of Cambridge. London, Rivingtons

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